The New Zealand

Journal of Agriculture.

VOL. 55. WELLINGTON, 20TH AUGUST, 1937. NO. 2.

PIG INDUSTRY.

BREEDING AND FEEDING FOR THE MARKET.

(Continued.)

M. J. SCOTT, Superintendent of the Pig Industry.

A COMBINED herd-book is issued under the auspices of the New Zealand Pig-Breeders' Association. One volume is issued each year, and about eighteen volumes have been issued to date. There are about 360 registered breeders in New Zealand, of whom about 190 breed Tamworths, about 100 Berkshires, forty Large Whites, and thirty Large Blacks, less than ten Middle Whites, and one or two Duroc Jerseys. From these breeds all sorts of crossbred pigs are produced and offered for sale on the English market in competition with a single distinctive line offered by other competitors for the trade. A moment's reflection will make it obvious that by gratifying the valueless idiosyncrasies of individual breeders we have done ourselves a great national disservice, without any individual actually getting any especial reward beyond his own satisfaction.

It should be possible without doing any injury to individuals to eliminate all but two breeds in the course of a few years, and from those remaining to produce a half-bred pig that would supply both the porker and baconer trade. It seems an easier problem to select and multiply good Tamworths and Berkshires, now widely distributed, than to improve our Large Whites or the conditions under which these are kept till we can be sure they will be satisfactory. In the end one or other of these plans must be followed if pigs continue to develop and the industry expands as it is capable of doing.

USE PURE-BRED STOCK.

As the pig industry has developed, so the importance of quality has increased. The English trade classes pigs into the following groups :—

	Approximate Dead Weights.
Porkers	61 to 80 lb.
Porkets	81 to 100 lb.
Cutters	101 to 120 lb.
Baconers	121 to 170 lb.

In addition, pigs of all weights below 60 lb. and all weights above 170 lb. are marketed in some part of England, but as a rule the 61 lb. to 80 lb. class is most popular, and gets a small premium. The next most popular is the bacon class, 130 lb. to 170 lb. General satisfaction is expressed at the quality of our porkers, but our baconers are either too short and light or too fat and heavy.

Generally they lack uniformity, and this can be most easily acquired by using standard types of breeding-stock. These standard types are fixed with greater certainty in purebred strains than they are in crossbred pigs, and, whatever the advantages of crossbred sows for breeding purposes, they are outweighed by the national good that would arise from marketing uniform pigs.

The Boar.

The importance of using a good boar can never be over emphasized. Pigs provide only carcass: there are neither wool nor milk factors to confuse the issue. All that is wanted is a good carcass, produced by quick-growing, efficient feed-converters. Pedigree breeders produce as many boars as sows each year, and since only a few boars are wanted there must be a very rigorous selection going on. Get a boar whose parents have proved their prolificacy, rapidity of growth, and ability to use feed efficiently. Up to the present a buyer has had to depend upon the integrity of the pedigree breeder, and while there are many who are satisfied with this arrangement, there are many who demand the testing of pedigree pigs, and a national testing service was instituted last year. This will expand and develop, and before long it should be possible to provide boars of proved ability. This should establish better relations between buyers and sellers, and encourage the wider use of pedigree stock for commercial pig-production. From a national point of view purebred boars should be used in order to produce uniform pigs. By this means we can most quickly establish that uniformity that is the hall-mark of quality.

Whatever the boar, he must be vigorous, active, and masculine, without being unduly coarse. Width between the legs, flat bone, nice-quality silky hair, alert carriage, standing well up on the toes, freedom from wrinkles, and evenness of temper are some of the external attributes of the good boar. He should have twelve to fourteen rudimentary teats evenly spaced and well forward on to the breast. Boars should be kept in a paddock by themselves, and fed as carefully as any other animal. If the boar is run with the sows it is impossible to keep farrowing dates, and, as a result, some sows must be abused. A boar may be used for a few sows at six months old, but he is given a better chance to develop and grow if he is not used until he is eight or even ten months old. It is advisable to detusk all boars, an operation that is quickly and easily done by tying the boar to a post or putting him in a bail (useful for ringing pigs) and cutting out the tusks with a wood-chisel.

The Sow.

It goes without saying that if efforts are spent in getting a good boar equal care must be given to the choice of a sow. As a rule the boar stamps his general outward appearance on his progeny, but it is claimed that the sow transmits stamina, ability to grow, and other non-visible health characters. Sows are often bought as weaners, and at that stage the only means of judging them is by their parents—usually their mother. A sow should have at least twelve to fourteen well-placed teats extending well on to the breast, be of quiet disposition, with plenty of length, good quarters, and well-sprung ribs. The thick, short-necked, narrow, or leggy or heavy-shouldered sow is not wanted. Never use sows or boars

out of litters that show any sign of rupture or other irregularity of testicle development in the boars of the litter. Rupture is an inherited weakness that must be present in both parents before it comes out in the offspring. Keep it out of breeding-stock by avoiding pigs from litters that show any sign of it.

A sow may be mated at six to seven months if particularly well grown, but such a sow will remain small till about the fourth litter. If well fed she will give just as good litters as well-grown sows can, but she will go to pieces on a poor feed-supply quicker than a matured sow. It is more general to wait till sows are eight months old—some let them go to ten months—before serving them. They produce bigger litters each time up to about the fourth or fifth, but at weaning the maiden sow may have as many and as good pigs as the older sow. As a rule the younger the sow the more careful she is to rear all the pigs born, and at about the sixth litter the element of carelessness has become so pronounced that from this stage onward the number of pigs reared per litter gradually falls off. Records show the following results for a number of sows :—

—	First Litter.	Second Litter.	Third Litter.	Fourth Litter.	Fifth Litter.	Sixth Litter.	Seventh Litter.	Eighth Litter.	Ninth Litter.	Tenth Litter.
Average number born	9	10	11	12	13	14	14	14	14	14
Average number reared	6·8	7·2	7·8	8·2	8·0	7·0	6·0	5·0	5·0	5·0
Average weight per piglet (lb.)	35·0	35·5	36·0	36·5	37·0	37·0	40·0	40·0	40·0	40·0

Renewal of Sows.

Although there are many good litters produced from sows that are over four years old, it pays to renew most sows after the sixth litter—*i.e.*, after they are three and a half years old. They have to fail sometime, and collected information shows that on the average they begin to fail after the sixth litter. It is possible to keep each sow until she actually does fail, but, since sow-renewal can be arranged so that it does not cost a great deal, it is safer to keep young sows. Kindly treatment of sows is as valuable as the best of feed and shelter, and costs nothing. Where sows are abused either by man or by circumstances, there one finds most trouble from pigs being eaten at birth and from being overlain. Being in harmony with her surroundings makes a sow profitable, and for this reason it is worth while confining a sow to her farrowing quarters fully three weeks before she farrows. She has time to adjust herself to possible changes of food, or temperature, or shelter, or outlook, or noise, or any of the things that may upset an overburdened matron. To guard against rough weather during the first two or three days after farrowing, it is probably safer to have the sow shut up for farrowing. Farrowing comes but once a year (or is it twice ?), and dead pigs show no profit, however carefully plans have been made for the other 364 days of the year !

Sows repay the owner for careful attention during the time they are suckling a litter, and just prior to this. Every one who has owned a sow knows what this means, and it is within most people's compass to provide that attention when they realize that it is worth while doing so.

Care of the Litter.

The litter lives on the sow's milk till they are about three weeks old. Just before this age is reached it is advisable to start the youngsters feeding on their own account. This is done with whole cow's milk most easily, but they can be encouraged to take any feed, and if they do this from their own trough behind a creep that keeps the sow away they are more likely to keep healthy and to feed better. At about three weeks old the litter often goes off a little, either through scours or some other infection, or if the litter is big, through insufficient to eat. Timely attention that tides them over this period gives them a better chance. A sod of fresh soil put in the pen daily often keeps them healthy, perhaps because of the iron or other element they get out of the soil, or perhaps because the earth performs some detoxicating action in their digestive system. Three weeks is a good time to castrate, the pigs are easily handled, are not so active as to do themselves any injury by racing round or fighting or getting into the dirt. Most of the rejects at the works due to faulty castration would be avoided if pigs were castrated earlier.

It has been observed that a further check often takes place at five weeks. This usually happens if the pigs are not by this time eating out of the troughs fairly readily. Weaning takes place as early as six and as late as ten weeks after farrowing. It is best to remove the sow and to keep on feeding the weaners for another month so as to keep them growing as fast as they will. There is only one way to do this. Give them as much as they will eat of good pig-food—fibrous foods are not suitable at this age—feed them regularly and cleanly, and keep them warm and dry. The sow comes on heat within three to five days after weaning, and should be put to the boar as late in the heat as possible. If she is missed at this stage, she is often difficult to get in pig later, because no automatic flushing occurs except at weaning-time. If she has been missed after weaning, shut the sow up and feed her well till she does come on heat.

POULTRY-FEEDING EXPERIMENTS, 1936-37.

W. L. Jourdain, Poultry Overseer, Government Poultry Farm, Wallaceville.

An experiment was carried out at the Wallaceville Poultry Station over the ten months from 1st April, 1936, to 31st January, 1937, for the purpose of ascertaining the respective merits for egg-production, of the following five methods of feeding: soaked wheat; soaked barley; bran and pollard mash; bran, pollard, and wheatmeal mash; and dry mash.

Two hundred pullets were used for the test, and were divided into five different pens of forty birds each as uniformly as possible. The houses were also of the same size and type throughout.

Feeding was carried out as follows: The birds in pens 1 and 2 each received two meals of soaked grain per day, one about 7 a.m. and the other about 4 p.m.; those in pens 3 and 4 received one mash meal per day about 7 a.m. and one grain meal per day about 4 p.m.; and those in pen 5 had the dry mash before them all the time, and in addition received a grain meal about 4 p.m. In addition approximately 2 lb. of oats were fed to each pen in the litter every midday as a scratch grain to induce them to "work," and after they had been given their last

meal at about 4 p.m. they were all given green food in the form of young green oats and silver beet. Oyster-shell and gravel grit was also supplied *ad lib.*

Pen 1. Soaked Wheat.

The method of feeding adopted with this pen was as follows :—

The amount of wheat required for each meal was first soaked in water for twenty-four hours. The water in which the wheat was soaked for each meal had approximately 1 per cent. of salt dissolved in it. For the morning meal the soaked wheat was dried off with the bran mixture (see Table 1), and for the evening feed it was dried off with plain bran and green food ; the amount of green food was approximately one-third of the total mixture of bran, wheat, and green food.

The amounts of food prepared and stored each time was as follows :—

Table 1.

Bran Mixture.	Bran.	Wheat.
17 lb. bran. 11 lb. meat-meal. 2 lb. linseed-meal. — 30 lb.	36 lb.	100 lb.

The amount of meat-meal averaged approximately 10 per cent. by measure of the wheat.

The birds in this pen, in common with pen 2, were transferred from the normal feeding—mash in the morning and grain in the evening—to the soaked wheat at morning and evening within a fortnight. The result of this drastic change was to put practically all the birds in these pens into a full moult within a month.

Several times it was noticed that the birds seemed to get tired of the soaked wheat and then in a few days they returned to their usual amount of feed. These birds did not consume as great an amount of soaked wheat as the amounts of foods consumed by the other pens in the test, with the exception of those on soaked barley. Never at any time did the pen 1 birds lay as well as the birds being fed on mash and grain diets.

Pen 2. Soaked Barley.

The method of feeding adopted with this pen was exactly the same as for pen 1 except that barley was substituted for wheat in the ration, which was as follows :—

Table 2.

Bran Mixture.	Bran.	Barley.
17 lb. bran. 11 lb. meat-meal. 2 lb. linseed-meal. — 30 lb.	36 lb.	100 lb.

The amount of meat-meal averaged approximately 10 per cent. by measure of the barley.

Comparing this pen with pen 1 very little difference was seen as far as the amount of food consumed was concerned, there being 147 lb. less

barley (see Table 6). Of course the difference between the prices of wheat and barley would give a further advantage still in the feeding-costs, but the smaller number of eggs from the barley pen would to a great extent offset that advantage.

There was a fairly heavy mortality with both pen 1 and pen 2. The majority of deaths in both these pens was due to vent-picking. To try to prevent this the amount of meat-meal was reduced considerably later in the experiment.

These birds never seemed to tire of the ration of soaked barley, although they never at any time ate a very great deal at a meal, appearing to be satisfied with less bulk than the birds on soaked wheat.

The birds in this pen, as mentioned before, went off into a heavy moult just after the commencement of the test, thereby affecting the egg-production considerably.

Pen 3. Bran and Pollard Mash.

This pen received only bran, pollard, and meat-meal in their mash, the mixtures for the mash and grain meals being as follows:—

Table 3.

Mash Mixture.	Grain Mixture.
32 lb. pollard.	60 lb. wheat.
9 lb. bran.	20 lb. maize.
9 lb. meat-meal	20 lb. barley.
1 lb. linseed-meal.	—
—	100 lb.
51 lb.	

The meat-meal was approximately 10 per cent. by measure.

The birds on this ration were always in the best of health, and always hungry and ready for their food. This pen ate more than any of the other pens at the commencement of the experiment and continued to do so until the finish.

The egg-production of this pen never dropped to the same extent as the two pens on the soaked grains, probably because there was not such a radical change in the system of feeding, and therefore there were not so many birds which dropped into a moult.

Pen 4. Bran, Pollard, and Wheatmeal Mash.

This pen was given bran, pollard, wheatmeal, and meat-meal in their morning mash and mixed grain in the evening as follows:—

Table 4.

Mash Mixture.	Grain Mixture.
18 lb. bran.	60 lb. wheat.
32 lb. wheatmeal.	20 lb. maize.
14 lb. pollard.	20 lb. barley.
13 lb. meat-meal.	—
—	100 lb.
77 lb.	

The meat-meal was approximately 10 per cent. by measure.

The mash-mixture for this pen was the standard mash used at this Station, and this pen was therefore the control pen for the whole experiment.

One bird in this pen died through digestive disorder, one with abdominal dropsy, two with ovarian trouble, and the other two were vent-picked.

These birds never went into a moult and never dropped in egg-production as much as any of the other pens in the experiment. It was naturally expected that they would not do so, as there had been no change in their diet or their treatment. The only reason why the birds in either this pen or the dry-mash pen (pen 5) should go into a moult would be that they had perhaps commenced to lay very early in the season. However, they did not lay as many as pen 3 even though pen 3 dropped more in production shortly after the test commenced.

Pen 5. Dry Mash.

This pen of pullets had been reared on dry mash since they were day-old chicks, and there had been no change in their diet since they were three months old. The dry mash with which they were fed was made up as follows :—

Table 5.

Mash Mixture.	Grain.
50 lb. maize-meal. 16 lb. bran. 16 lb. pollard. 4 lb. meat-meal. 4 lb. milk-powder. 4 lb. linseed-meal. 2 lb. bonedust. ½ lb. salt. 96½ lb.	Wheat.

After these birds commenced to lay (which was before the experiment started) they went right ahead, with the exception of a few weeks just after the beginning of the experiment, when they seemed to be at a standstill. However, after they got over that period they went ahead rapidly and laid well, finishing about 700 eggs ahead of the next highest pen.

Even though they had the dry mash before them all the time, they still gave every indication that they relished their grain feed at 4 p.m.

The following tables give—

(1) The costs and the amounts of food consumed (Table 6) :

(2) The number of eggs laid and the amount received for them (Table 7).

Table 6.—Quantities and Costs of Food consumed.

Foodstuff.	Average Price.	Pen 1.		Pen 2.		Pen 3.		Pen 4.		Pen 5.	
		Quantity used.	Cost.	Quantity used.	Cost.	Quantity used.	Cost.	Quantity used.	Cost.	Quantity used.	Cost.
		Lb.	£ s. d.	Lb.	£ s. d.	Lb.	£ s. d.	Lb.	£ s. d.	Lb.	£ s. d.
Wheat ..	5s. 9·25d. per bushel	1,965	9 9 0	..	..	1,020	4 18 1	810	3 17 11	1,182	5 13 8
Barley ..	3s. 4·83d. per bushel	..	..	1,818	6 3 8	340	1 3 2	270	0 18 4	..	..
Oats	4s. per bushel ..	614	3 1 5	614	3 1 5	614	3 1 5	614	3 1 5	614	3 1 5
Maize.. ..	6s. 10·91d. per bushel	..	..	..	..	340	2 1 11	270	1 13 4	..	..
Bran	£6 5s. 8d. per ton ..	375	1 3 7	353	1 2 2	214	0 13 5	249	0 15 8	254	0 15 11
Pollard ..	£7 3s. 8d. per ton ..	..	..	..	..	763	2 14 10	192	0 13 10	253	0 18 2
Meat-meal ..	£7 6s. 8d. per ton ..	125	0 9 2	107	0 7 10	234	0 17 2	180	0 13 2	65	0 4 9
Wheatmeal ..	£9 15s. per ton ..	..	..	..	..	..	..	442	2 3 1	..	..
Maize-meal ..	£12 15s. per ton ..	..	..	..	..	..	..	..	..	792	5 1 0
Linseed-meal ..	15s. per 100 lb. ..	23	0 3 5	21	0 3 2	24	0 3 7	..	..	63	0 9 5
Oyster-shell grit	4s. 6d. per 100 lb. ..	100	0 4 6	100	0 4 6	131	0 5 11	106	0 4 9	131	0 5 11
Milk-powder ..	£2 9s. per cwt. ..	..	..	..	..	..	..	..	..	63	1 7 7
Bonedust ..	9s. 6d. per cwt. ..	..	..	..	..	..	..	..	..	32	0 2 9
Salt	1d. per lb.	9½	0 0 10	9½	0 0 10	..	..	..	..	8	0 0 8
Total costs	..	..	14 11 11	..	11 3 7	..	15 19 6	..	14 1 6	..	18 1 3

Table 7.—Eggs laid and Amount received in respect of each Pen.

Month.	Average Price per Dozen.	Pen 1.		Pen 2.		Pen 3.		Pen 4.		Pen 5.	
		Dozen.	Value.	Dozen.	Value.	Dozen.	Value.	Dozen.	Value.	Dozen.	Value.
			£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s. d.
April	2s. 3·8d. ..	20 7/12	2 7 8	14 8/12	1 14 0	26 3/12	3 0 10	31 6/12	3 13 0	56	6 9 9
May	2s. 4·5d. ..	13 7/12	1 12 3	12 4/12	1 9 4	19 6/12	2 6 4	22 8/12	2 13 10	31 10/12	3 15 7
June	1s. 10·8d. ..	23 8/12	2 5 0	26 2/12	2 9 8	24 11/12	2 7 4	27 6/12	2 12 3	33 11/12	3 4 5
July	1s. 4·5d. ..	32 7/12	2 4 10	47 3/12	3 4 11	51 4/12	3 10 7	39 2/12	2 13 10	49 5/12	3 7 11
August	1s. 3·8d. ..	49 4/12	3 5 0	48 9/12	3 4 2	62 4/12	4 2 1	57 7/12	3 15 10	62 11/12	4 2 10
September	1s. 0·75d. ..	59 1/12	3 2 9	46 10/12	2 9 9	64 1/12	3 8 1	61	3 4 10	67 9/12	3 12 0
October	1s. 2·125d.	56 11/19	3 7 0	50	2 18 10	68 3/12	4 0 4	59 3/12	3 9 9	69 9/12	4 2 1
November	1s. 3·4d. ..	52 8/12	3 7 7	48 5/12	3 2 2	64 4/12	4 2 6	53 4/12	3 8 5	63 4/12	4 1 4
December	1s. 5·5d. ..	46 7/12	3 7 11	34 11/12	2 10 11	56	4 1 8	49 6/12	3 12 2	57 11/12	4 4 6
January	1s. 6·5d. ..	40	3 0 10	34 6/12	2 12 6	49 1/12	3 14 8	52 5/12	3 19 9	51 1/12	3 17 8
Totals	..	395	28 0 10	363 10/12	25 16 3	486 1/12	34 14 5	453 11/12	33 3 8	543 11/12	40 18 1

Table 8.—Net Profit over Cost of Foods.

Pen No.	Number of Birds at Start of Test.	Number of Weeks.	Approximate Average Number of Birds during Test.	Total Number of Eggs Sold (in Dozens).	Amount received for Eggs.	Total Cost of Food.	Differences.
					£ s. d.	£ s. d.	£ s. d.
1 ..	40	39½	37	395	28 0 10	14 11 11	13 8 11
2 ..	40	39½	35	363 10/12	25 16 3	11 3 7	14 12 8
3 ..	40	39½	39	486 1/12	34 14 5	15 19 6	18 14 11
4 ..	40	39½	36	453 11/12	33 3 8	14 1 6	19 2 2
5 ..	40	39½	38	543 11/12	40 18 1	18 1 3	22 16 10

SUMMARY.

The details given in the last table (Table 8) reveal the result of the experiment at a glance. It will be seen from this that the cost of food for pen 5 was considerably more than that of any of the other pens, costing £2 1s. 9d. more than the next highest. Against the higher cost, however, these birds laid more eggs than any other pen, thereby more than paying for the extra cost of feed. As will be seen, the two pens on soaked grains gave the poorest results in this test; but, considering that the majority of these birds went into a moult soon after the experiment commenced, it would not be fair to compare their results with those of pen 5.

Another point of interest is that the pullets in both pens 4 and 5 were sexed pullets—that is, sexed as day-old chicks—whereas the other pullets in pens 1, 2, and 3 were not sexed. The results of the test would therefore prove that sexing does not harm the pullet in any way as far as egg-production is concerned.

The results of this experiment is not taken as conclusive, and therefore a further experiment along the same lines is being carried out during 1937–38.

MULCHING OF CITRUS TREES.

SEVERAL growers in the Auckland District are paying more attention to mulching their citrus trees in order to get a greater supply of organic matter into the soil. This work has been going on for several years, and the advantage is now to be plainly seen, first in the dark-green foliage with a smooth surface, and secondly in the skin of the fruit itself, which is very smooth and clear.

In both instances where this is done the method is to have a separate field in which the grass or clovers are grown, and this is cut during the late summer, and the material placed around the trees well out to the spread of the branches. This material very soon decays and mingles freely with the soil, and by this means it is kept in a good mechanical condition such as the tree requires in order to flourish. A certain quantity of artificial manure is also used, but the quantities have been reduced by nearly half since the mulching has been carried out.

This practice may also be applied with other fruits where it is practicable, and material for mulching purposes can be obtained especially in those localities where the soils are deficient in organic matter.

WHEAT-VARIETY TRIALS.

OPERATIONS FOR SEASONS 1935–36 AND 1936–37.

J. W. Woodcock, Crop Experimentalist.

The wheat-variety trials conducted by the Fields Division over the past two seasons have been mainly directed towards the testing-out in various districts of new varieties which are either foreign wheats introduced by, or crosses bred by, the Wheat Research Institute. In each experiment an endeavour is made to select a locality characteristic of the district. In testing out a new variety its characteristics are taken into account when selecting the localities for trials, as well as the ecological conditions of these localities, so that, taking all experiments of the variety, a wide range of ecological conditions is covered. Close collaboration is now maintained between the Institute and the Fields Division, not only in the general field trials, but also in the preliminary work which involves the final selection of some dozens of crossbred lines, and the institution of "ecological trials" in several districts is of some assistance to the geneticist, Dr. Frankel, in selecting those lines which show promise.

Varieties under Trial.

In the experiment under review either Solid Straw Tuscan or Cross 7 have been taken as the standard variety with which the others were compared. In most cases both the above were included.

Marquis.—Trials with this variety were confined to Marlborough, where it is popular and is apparently capable of giving satisfactory yields of high-quality grain.

Federation.—This variety has for some years past held an important position in Marlborough, although it is now gradually losing favour.

Jumbuck.—In view of its reputation in the North Island and the need of a satisfactory wheat for spring sowing in the South, the use of Jumbuck has increased in the South Island during recent years.

Nabawa and Ford.—The possibilities of these two Australian varieties, introduced by Mr. A. Grant, Waimate, for spring sowing, were investigated.

Tainui and Taiaroa.—Formerly named S 617 and S 668 respectively, these two varieties, originating from Portugal, were selected by the Wheat Research Institute from a number of imported lines. They have shown much promise as spring-sown wheats in small-scale trials in Otago, and also in large-scale trials at Morven and Lincoln College in the 1934–35 season. Tainui is one of the earliest maturing varieties known in New Zealand.

Lin Calel.—This is a well-known wheat from the Argentine, where it ranges amongst those with highest grain quality. In

preliminary trials at the Pure Seed Station, Lincoln, it gave good results. It gives promise also of being a high-quality wheat, although, being a bearded variety, its appearance in the field is somewhat unattractive.

Bencubbin.—This variety from Western Australia is being grown in North Otago, and from reports obtained from farmers appears to prove satisfactory in that district.

Cross 31.—From the point of view of baking score and general agronomic characters the various lines of Cross 31 are similar to Solid Straw Tuscan. It was considered after preliminary trial, however, that the best lines would generally outyield Tuscan.

Method of conducting Experiments.

Most of the trials were laid down in blocks with eight to ten replications of each variety. In others a modification of the "Beaven half-drill strip" method was employed, each variety being compared with adjacent control plots. The results were mostly examined statistically by the analysis of variance or by "students" method, except in Marlborough, where no facilities are available for threshing plots separately. A standard rate of seeding of 2 bushels per acre for each variety was generally adopted, and 1 cwt. of superphosphate was sown with the seed. Harvesting was usually carried out when the later-ripening varieties were in fit condition, although under some circumstances earlier-maturing varieties were cut with a scythe before the remainder. At harvest samples of each variety were collected and sent to the Wheat Research Institute for milling and baking tests.

Summary of 1935–36 Season's Trials.

Twelve trials were harvested in 1935–36, and the yields, together with remarks on the condition of varieties at harvest, are given in the tables and notes which follow:—

A. *Marlborough Trials.*

Varieties compared: S.S. Tuscan, Cross 7, Marquis, and Federation (soft).

(1) *M. Walsh, Omaka.*—Date sown: 12th June, 1935. Date harvested: 6th January, 1936.

When cut Federation appeared to be the heaviest yielder, but differences were small. Birds had attacked all varieties to some extent, and the Federation in particular. Birds were troublesome when the crop was in stook and Federation suffered severely.

(2) *Smith Bros., Tua Marina.*—Date sown: 22nd August, 1935. Date harvested: 30th January, 1936.

When cut S.S. Tuscan had a very poor appearance, and had been heavily attacked by rust. Cross 7 was also showing rust to some extent.

Table I.—Yields of Marlborough Trials, 1935-36.

Variety.	Omaka.		Tua Marina.	
	Yield per Acre.	Increase over S.S. Tuscan.	Yield per Acre.	Increase over S.S. Tuscan.
	Bushels.		Bushels.	
S.S. Tuscan	34·4	..	30·1	..
Cross 7	33·8	−0·6	32·2	2·1
Marquis	30·6	−3·8	39·3	9·2
Federation	29·9	−4·5	36·7	6·6

Differences were not examined statistically.

B. *Trials with Spring-sown Wheats.*

Varieties compared: S.S. Tuscan, Cross 7, Jumbuck, Nabawa, Ford, Tainui, and Taiaroa.

(3) *J. O. Redfern, Darfield.*—Date sown: 14th August, 1935. Date harvested: 21st January, 1936.

Some of the plots were damaged by weather, but sufficient were harvested for estimation of yield.

(4) *Mrs. C. Hall, St. Andrews.*—Date sown: 9th September, 1935. Date harvested: 12th March, 1936.

Plots were over-ripe, as cutting had been delayed by weather. Tainui suffered the most through not being cut at the right stage.

(5) *A. Grant, Waimate.*—Date sown: 16th September, 1935. Date harvested: 18th February, 1936.

In the early stages Jumbuck appeared poor, and did not appear to have tillered well. The grain of all varieties was badly sprouted through adverse weather conditions.

Table II.—Yield in Bushels per Acre of Spring-sown Trials, 1935-36.

Variety.	(3) Darfield.		(4) St. Andrews.		(5) Waimate.	
	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S. Tuscan.
S.S. Tuscan ..	33·4	..	24·1	..	22·2	..
Cross 7	31·5	−1·6 N.S.	25·5	1·4 N.S.	26·5	4·3 S.
Jumbuck ..	32·2	−1·2 N.S.	17·8	−6·3 S.	24·8	2·6 N.S.
Nabawa	33·3	−0·1 N.S.	27·0	2·9 S.	29·7	7·5 S.
Ford	33·8	0·4 N.S.	29·6	5·5 S.	27·8	5·6 S.
Tainui	45·4	12·0 S.	29·6	5·5 S.	39·0	16·8 S.
Taiaroa	42·4	9·0 S.	36·4	12·3 S.	29·7	7·5 S.

In this and the tables which follow S. denotes significant difference and N.S. difference not significant.

C *Trials with Lines of Cross 31.*

Varieties compared: S.S. Tuscan, six lines of Cross 31. (Cross 7 was included in the Lincoln College trial.)

(6) *R. and P. Campbell, Kingsdown.*—Date sown: 1st August, 1935. Date harvested: 10th February, 1936.

Prior to harvest the lines of Cross 31 did not appear to be as well grown as the Tuscan plots.

(7) *Lincoln College.*—Date sown: 30th April, 1935. Date harvested: 20th January, 1936.

The trial was carried out by the Wheat Research Institute, but results are included for comparison with trial 6.

Table III.—Yield in Bushels per Acre of Lines of Cross 31 as compared with S.S. Tuscan, 1935–36.

Variety.	(6) Kingsdown.		(7) Lincoln.	
	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S. Tuscan.
S.S. Tuscan (mean)	47·3	..	66·6	..
Cross 31,01	46·4	−0·3 N.S.	75·3	4·7 S.
Cross 31,02	48·8	2·1 N.S.	75·1	7·9 S.
Cross 31,03	47·1	−0·2 N.S.	77·2	11·4 S.
Cross 31,04	46·8	−0·5 N.S.	75·6	8·4 S.
Cross 31,05	46·3	−1·7 N.S.	80·6	13·1 S.
Cross 31,06	45·0	−2·9 S.	78·2	10·0 S.
Cross 7	..	..	74·1	3·6 S.

D. *Other Trials.*

Two experiments with selections of S.S. Tuscan were carried out, but did not show any superiority of the selections over commercial Tuscan. Four small-scale trials were sown in Otago and Southland, and the varieties included were S.S. Tuscan, Taiaroa, Jumbuck, Montana King, and Cross 7. The trials consisted of hand-sown plots protected by bird-netting. At harvest they were cut by hand, and the sheaves were forwarded to the Wheat Research Institute for threshing. The strike was a failure in one of the trials, and it had to be abandoned. Jumbuck gave distinctly poor returns in all three trials, while Montana King was only a little better. Cross 7 was poor at two centres, and was equal to Tuscan at the third. Taiaroa yielded as much as Tuscan at Greenfield and Benmore, and there was an indication that it yielded as much as Tuscan or possibly more at Winton, where, however, its straw was slightly tangled.

Summary of 1936–37 Season's Trials.

Twelve experiments were carried out by the Fields Division in 1936–37, and these included three small-scale trials in the North Island. Owing to excessive growth of wild tares, one experiment in the Ashburton district had to be abandoned. The yields and remarks on the varieties are as follows:—

A. *Marlborough Trials.*

Varieties compared: Cross 7, Marquis, Tainui, Jumbuck, and Federation.

(1) *F. F. Mills, Grovetown.*—Date sown: 11th July, 1936. Date harvested: 15th January, 1937.

At time of cutting most of the varieties were down except Cross 7. Tainui was the first to ripen, followed by Marquis and Jumbuck, and then Cross 7.

(2) *I. Brown, Grovetown.*—Date sown: 8th July, 1936. Date harvested: 12th January, 1937.

Difficulty was experienced in harvesting all varieties except Cross 7, on account of lodging, and this was particularly so in the case of Marquis. Cross 7 was perfectly upright and showed no signs of lodging.

Table IV.—Yields in Bushels per Acre in Marlborough Trials, 1936–37.

Variety.	(1) Grovetown.		(2) Grovetown.	
	Yield.	Increase over Cross 7.	Yield.	Increase over Cross 7.
Cross 7	59·4	..	49·2	..
Marquis	60·9	1·5	54·7	5·5
Tainui	53·8	−5·6	53·5	4·3
Jumbuck	59·1	−0·3	*	*
Federation	*	*	55·3	6·1

* Not included.

B. *Trials with Cross 31.*

Varieties compared: S.S. Tuscan, Cross 7, Lin Calel, and Crosses 31,02, 31,03, and 31,05.

(3) *Mrs. C. Hall, St. Andrews.*—Date sown: 18th June, 1936. Date harvested: 16th February, 1937.

All plots were ripe when cut. Cross 7, Crosses 31,02 and 31,03, as well as Tuscan were slightly over-ripe, but no shedding of grain had taken place. Cross 31,05 had lodged badly, and S.S. Tuscan to some extent.

(4) *E. A. Payne, Amberley.*—Date sown: 28th May, 1936. Date harvested: 28th January, 1937.

No differences were observed between varieties at harvest; all were ripe.

Table V.—Yields in Bushels per Acre in Trials with Crosses 31, 1936–37.

Variety.	(3) St. Andrews.		(4) Amberley.	
	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S. Tuscan.
S.S. Tuscan	34·3	..	27·0	..
Cross 31,02	45·1	10·8 S.	30·3	3·3 S.
Cross 31,03	46·6	12·3 S.	29·8	2·8 N.S.
Cross 31,05	42·3	8·0 S.	30·2	3·2 N.S.
Cross 7	39·0	4·7 N.S.	30·1	3·1 N.S.
Lin Calel	33·7	−0·6 N.S.	29·1	2·1 N.S.

C. *Trials with "Spring" Wheats.*

Varieties compared: S.S. Tuscan, Cross 7, Lin Calel, Tainui, Jumbuck, and Bencubbin.

(5) *G. Warren, Darfield.*—Date sown: 12th August, 1936. Date harvested: 11th February, 1937.

Tainui and Jumbuck ripened earlier than the remainder, and were badly attacked by birds. Lin Calel, which is a bearded variety, was definitely not attacked.

(6) *G. Stevenson, Weston.*—Date sown: 25th August, 1936. Date harvested: 26th February, 1937.

At harvest S.S. Tuscan was slightly green, but sufficiently mature to cut. The remainder were ripe. Hessian fly had attacked Tainui, Jumbuck, Lin Calel, and Bencubbin, resulting in damage to the straw.

(7) *Manly Bros., Duntroon.*—Sown on 10th June, 1936. Jumbuck, Tainui, and Bencubbin were harvested on 13th January, 1937. Lin Calel, S.S. Tuscan, and Cross 7 were harvested on 1st February, 1937.

When cut Bencubbin had shaken rather badly, while Jumbuck and Tainui had also shed some grain.

Table VI.—Yields of Varieties in Type C Trials, 1936–37 (Bushels per Acre).

Variety.	(5) Darfield.		(6) Weston.		(7) Duntroon.	
	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S. Tuscan.
S.S. Tuscan ..	20·9	..	20·6	..	23·9	..
Cross 7 ..	24·8	3·9	20·2	−0·4 N.S.	24·4	0·5 N.S.
Lin Calel ..	29·7	8·8*	19·2	−1·4 N.S.	21·9	−2·0 N.S.
Tainui ..	25·6	4·7†	18·5	−2·1 N.S.	17·9	−6·0 S.
Jumbuck ..	16·4	− 4·5†	14·2	−6·4 S.	17·4	−6·5 S.
Bencubbin	..	..	16·8	−3·8 N.S.	23·4	−0·8 N.S.

* Neglected by birds. † Badly attacked by birds.

D. *Ecological and North Island Trials.*

A large ecological trial was sown on the farm of P. R. Talbot, Claremont, in which twenty-seven lines of Crosses 36 and 60 were tested on behalf of the Wheat Research Institute. It is not intended, however, to quote results in this report.

In the North Island small-scale trials comparing Jumbuck, Tainui, and Taiaroa were laid down at Feilding, Marton, and Colyton respectively. These plots were hand-sown, and at harvest cut by hand, the sheaves being forwarded to the Wheat Research Institute for threshing. Tainui was significantly better than Jumbuck at all centres, and was significantly higher in yield than Taiaroa at Marton and Colyton. Taiaroa outyielded Jumbuck significantly at Feilding.

Summary.

The main features of the two seasons' results given above are summarized below:—

(1) *Cross 7.*—In comparison with Solid Straw Tuscan, Cross 7 performed well during the two seasons under review. Although in Marlborough Cross 7 did not show up to the same advantage as it has done in previous seasons, and was in fact outyielded by Marquis in three out of four trials, in view of its earliness, excellent straw, and reliable yield, Cross 7 can still be recommended. During the past two seasons in Canterbury Cross 7 has never been outyielded by Tuscan, and was definitely superior in two trials. Its resistance to lodging, shorter straw, and earlier maturity have been valuable characteristics in view of the weather conditions experienced at harvest.

(2) *Tainui and Taiaroa.*—Both these varieties show good promise as spring wheats. Tainui appears particularly suitable for Canterbury, while Taiaroa is apparently more suited to South Otago conditions. A nucleus of seed of these varieties is being raised at the Pure Seed Station, and stocks will be ready for limited distribution for the sowing-season of 1938. In the meantime further trials with Tainui are contemplated in the North Island, where the possibilities of this variety are indicated especially in localities in which lodging as a rule is not severe.

(3) *Cross 31.*—As an alternative to Solid Straw Tuscan some of the lines of Cross 31 show distinct possibilities. Three of the lines of Cross 31 have performed well in both seasons in relation to Tuscan. At Lincoln in 1935–36 and St. Andrews in 1936–37 there was a wide margin in favour of the Crosses. Two of these lines, 31,02 and 31,05, have been retained for further trial.

(4) *Jumbuck.*—This variety has not shown to advantage in any of the trials. Owing to its early maturity, it has in some cases suffered from bird damage, which has been reflected in decreased yield.

(5) *Lin Calel.*—Both in autumn and spring sowings this variety has shown good promise, and out of five trials it was equal to Tuscan in four and superior in one, although in the latter there may have been differential damage by birds.

(6) *Other Varieties.*—Bencubbin has not shown any advantage over Tuscan in the two North Otago trials, although the prolonged drought during winter and spring probably favoured Tuscan and other later varieties. In Marlborough the variety known as "Federation" was inferior to Cross 7 in one trial and superior in two experiments, but in the two latter Marquis has also performed well. The yields from Marquis during the last few years' trials in Marlborough give further foundation to the popularity of this variety in the province. The two Australian varieties Nabawa and Ford gave good yields, but neither gave the same promise as Tainui as a satisfactory spring wheat for Canterbury conditions.

ACKNOWLEDGMENTS.

The Department extends its thanks to those farmers who provided land and facilities for carrying out the experiments. The field-work in the large-scale trials was carried out under the direction of Mr. R. McGillivray and Mr. J. M. Smith, Fields Superintendents at Christchurch and Dunedin respectively, by the following Instructors: H. de O. Chamberlain and D. R. Wilkie, Marlborough; A. V. Allo, Christchurch; C. C. Leitch, Timaru; T. Sellwood, Oamaru.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published recently in the *New Zealand Patent Office Journal*, include the following of agricultural interest:—

No. 77980: Milking-machine; R. J. Daniell. No. 78007: Butter-pounding attachment; G. McHugh. No. 78017: Milking-machine; Aktiebolaget Separator. No. 78026: Casein-drying machine; Mullan and Foy. No. 78040: Animal drencher; W. Peirson. No. 78042; Ragwort-gun; J. Morice. No. 78044: Fertilizer-distributor; K. Burgess. No. 78056: Grass-drying means; Kaloroil Burners, Ltd., and A. Goldberg. No. 78072: Milk-process; F. Jung. No. 78102: Honey-purification process; Cawthron Institute Trust Board. No. 78106: Drench-administering gun; Loudon Brothers, Ltd.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid.

EXPERIMENTS ON THE CONTROL OF TOMATO LEAF-MOULD.

E. E. CHAMBERLAIN and R. M. BRIEN, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research, and W. K. DALLAS and E. T. TAYLOR, Horticulture Division, Department of Agriculture.

LEAF-MOULD (*Cladosporium fulvum*) is, in New Zealand, the most troublesome and widely spread disease of glasshouse tomatoes. It was first recorded in the Dominion by Kirk in 1897. Chamberlain (1932) published an account of this disease, giving symptoms, economic significance, life history, and preventive measures. It was pointed out that the basis of any successful treatment must be the provision of adequate ventilation. It is not possible, however, under all conditions to provide sufficient ventilation to prevent leaf-mould from becoming established. In such circumstances it is the practice to apply therapeutants to help keep the disease in check. The present investigation was directed to the determination of the relative efficiency of those commonly recommended. In this article the results are recorded of three seasons' (1934–36) experiments. They were carried out at Lower Hutt, Wellington, in commercial glasshouses made available through the courtesy of the Hutt Valley Tomato-growers' Association.

EXPERIMENTAL METHOD.

Experiment I (1934) was carried out in an unheated glasshouse where leaf-mould had previously occurred, and experiment II (1935) in a newly constructed unheated house. In the latter a high percentage of infection developed, and the same house was used in 1936 for experiment III.

Treatments were commenced when the plants were 12 in. to 18 in. high before the disease was observed on any plants. Applications were continued every eighteen to twenty-one days in experiments I and II, and at fourteen-day intervals in experiment III, until harvesting commenced, the plants then being 6 ft. to 7 ft. high.

In 1934 a bucket pump with cyclone nozzle was used for the first three applications, and knapsack sprayers with bordeaux nozzles for the fourth. The first two sprayings during 1935 were applied by means of a bucket pump and the last two with knapsacks, while in 1936 a bucket pump was used throughout. With the bucket pump it was possible to maintain a good pressure and provide a driving mist of fine particles. Only a low pressure (10 lb. to 15 lb.) could be secured with the knapsack sprayer, and this resulted in a coarse spray, having poor penetration. In all cases the operator endeavoured to secure a good spray coverage on both sides of the leaves. A noticeably better coverage was obtained with the bucket pump. In all experiments sprays were applied at a rate necessary for adequate cover, requiring half a gallon per row of thirteen to fourteen plants for the first treatment, and increasing with each application to 1 gallon per row for the final treatment.

Dusts were applied with a rotary hand-blower during 1934 and 1936, and with a small hand-duster in 1935. An attempt was made to secure a covering of dust particles on both the upper and lower leaf surfaces.

After leaf-mould infection was observed, counts were taken of the number of lesions on one leaf of each plant at approximately the same height. Further counts were made immediately before each subsequent application. Although this method of determining the relative amounts of infection occurring in the various treatments was not entirely satisfactory, the short time at our disposal did not permit of more comprehensive measurements.

The crops were visited only at the time of spraying, and the management of the glasshouses was left entirely in the hands of the growers. Under these circumstances there was no correlation between the spraying experiments and the more important means of control by ventilation.

Materials used.

(1) *Ground Sulphur (Flour Sulphur).*—The particle size varies considerably according to the grade of sample, ranging from a minimum of about 4 μ to a maximum of 250 μ. It was employed as a dust both alone and in combination with gas-sulphur.

(2) *Sublimed Sulphur (Flowers of Sulphur).*—This material consists of particles varying from 8 μ to 30 μ aggregated into groups, sometimes attaining a size of 400 μ. The aggregates do not break up when applied to the plants. Sublimed sulphur was used as a dust only.

(3) *Gas-sulphur.*—The particle size ranges from 2 μ to 10 μ with an average of about 5 μ. In these experiments one product of this type was used as a spray and two others as dusts, one of the latter being in combination with ground sulphur.

(4) *Colloidal Sulphur.*—Sulphur in a very fine state of subdivision, the majority of particles being 0·1 μ to 0·5 μ. Colloidal sulphurs are available in the form of pastes containing 40 per cent. to 50 per cent. of sulphur. They also contain a colloid which acts as a dissociant and a suspensor.

(5) *Lime-sulphur.*—The active constituent of lime-sulphur is a mixture of polysulphides of calcium. The polysulphide content of the products used was 18 per cent. in experiment I and 15 per cent. in experiments II and III.

(6) "*Shirlan A.G.*"—A proprietary product composed of 25 per cent. salicylanilide, 10 per cent. of a wetting-agent ("Agral"), and 65 per cent. water. The salicylanilide, which is the active constituent, has a particle size of 0·5 μ to 12 μ, the majority of particles being 1 μ to 2 μ.

(7) "*Agral.*"—This is a proprietary organic wetting-agent.

Experiment I (1934).

Treatments were carried out on the following varieties: "Britain's Best," 7 rows; "Salad Gem," 46 rows; "Marvel," 18 rows; and

"Kondine Red," 9 rows. Sprays applied were as follows: "Shirlan A.G.," 0·3 per cent.; colloidal sulphur, 0·2 per cent.; gas-sulphur, 0·2 per cent.; lime-sulphur, 0·083 per cent.*; lime-sulphur, 0·083 per cent., plus colloidal sulphur, 0·2 per cent. Sublimed sulphur was used as a dust. Untreated control plots were left between each set of six treatments. The first application was made on September 26th, and subsequent applications on October 16th and November 1st and 19th.

Results.—Leaf-mould was first observed on October 16th, 1934, infection being confined to occasional leaves on scattered plants. On November 1st counts were taken and these showed that "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur all gave some measure of control. Colloidal sulphur and gas-sulphur did not reduce infection, while lime-sulphur plus colloidal sulphur had no advantage over lime-sulphur alone.

The plants were again examined on November 19th and December 7th, but leaf-mould infection was so severe that no counts were taken. Observations showed that there was a slight reduction in incidence of infection on plants treated with "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur, but the other treatments had no apparent effect on the disease.

Experiment II (1935).

The varieties treated were "Early Market," 39 rows, and "Peter's Special," 27 rows. The treatments carried out were as follows: "Shirlan A.G." 0·3 per cent., colloidal sulphur 0·2 per cent., lime-sulphur 0·083 per cent., lime-sulphur 0·083 per cent. plus colloidal sulphur 0·2 per cent. as sprays; and sublimed sulphur and gas-sulphur as dusts. Applications were made on October 8th and 25th and November 12th and 29th.

Results.—Leaf-mould was first observed on November 12th, 1935, when occasional lesions were found on plants scattered throughout the house. During the next two visits counts were taken, the results of which are given in Table I. They show that "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur all brought about some reduction in amount of infection. Lime-sulphur plus colloidal sulphur appears to have been slightly more effective than the others, and sublimed sulphur slightly less so. Colloidal sulphur alone and gas-sulphur dust had little effect on the disease.

A final inspection of the plants was made on December 20th, 1935, and all plants found to be heavily infected. From observations it

* Lime-sulphur 0·083 per cent. and 0·1 per cent. refers to the percentage of polysulphide. Thus—

Lime-sulphur 0·083 per cent. = 1–216 for a lime-sulphur of 18 per cent. polysulphide content, and 1–180 for a lime-sulphur of 15 per cent. polysulphide content.

Lime-sulphur 0·1 per cent. = 1–180 for a lime-sulphur of 18 per cent. polysulphide content, and 1–150 for a lime-sulphur of 15 per cent. polysulphide content.

appeared that in the case of the variety "Early Market" "Shirlan A.G." was the only treatment which had had any beneficial effect on the plants. Plants treated with this material not only appeared to show less leaf-mould, but also less of a physiological scorch which was present on leaves of plants in all other treatments and controls. In the case of the variety "Peter's Special," plants treated with "Shirlan

Table I.—Results of Experiment II, 1935.

Treatment.*	Percentage.	Number of Rows.	Average Number of Lesions per Row.	
			Nov. 12th, 1935.	Nov. 28th, 1935.
Variety "Early Market," Thirteen Plants per Row.				
Check	..	2	25	74
Colloidal sulphur	0·2	2	32	65
Gas-sulphur	Dust	2	25	72
Sublimed sulphur	Dust	2	23	75
"Shirlan A.G."	0·3	2	39	40
Check	..	2	81	173
Lime-sulphur + Colloidal sulphur	0·083+ 0·2	2	38	70
Lime-sulphur	0·083	2	32	143
"Shirlan A.G."	0·3	2	23	73
Gas-sulphur	Dust	2	29	98
Check	..	2	22	144
Sublimed sulphur	Dust	2	16	51
Colloidal sulphur	0·2	2	17	85
Lime-sulphur + Colloidal sulphur	0·083+ 0·2	2	17	32
Lime-sulphur	0·083	2	34	53
Check	..	3	39	94
Lime-sulphur	0·083	3	22	55
Check	..	3	30	77
Variety "Peter's Special," Thirteen Plants per Row.				
Sublimed sulphur	Dust	3	3	49
Check	..	3	10	79
Gas-sulphur	Dust	4	17	95
"Shirlan A.G."	0·3	4	18	59
Lime-sulphur	0·083	4	16	85
Check	..	3	23	127
Colloidal sulphur	0·2	3	18	88
Lime-sulphur + Colloidal sulphur	0·083+ 0·2	3	12	35

* The order of the treatments as listed in both tables represents their relative positions in the glass-house.

A.G.," lime-sulphur, and lime-sulphur plus colloidal sulphur were slightly healthier in appearance than those of the controls or of the other treatments.

Plants treated with gas-sulphur were showing noticeable leaf injury* when examined on November 12th, and this was still apparent on November 28th.

* This injury was probably induced by impurities often present in this product.

Table II.—Results of Experiment III, 1936.

Treatment.	Percentage.	Number of Rows.	Average Number of Lesions per Row.		
			Nov. 13th, 1936.	Nov. 27th, 1936.	Dec. 11th, 1936.
Variety "Early Market," Fourteen Plants per Row.					
West Side of Glasshouse.					
Check	..	1	15	120	87
Lime-sulphur ..	0·1	2	6	13	36
Lime-sulphur ..	0·083+	2	0·5	5	6
"Agral"	0·1				
Check	..	2	12	16	14
Lime-sulphur ..	0·083	2	2·5	8	13
Sublimed sulphur ..	Dust	2	10	20	13
Check	..	2	8	5	8
Gas-sulphur ..	20+	2	11	16	19
Ground sulphur ..	80 Dust				
"Shirlan A.G." ..	0·47	2	2·5	1	7
Check	..	2	13	25	52
"Shirlan A.G." ..	0·23	2	3	3	2
Lime-sulphur ..	0·1	2	1·5	8	15
Check	..	2	20	19	52
"Shirlan A.G." ..	0·47	2	7	17	33
Lime-sulphur ..	0·083	2	9	19	50
Check	..	2	30	44	129
Ground sulphur ..	Dust	2	30	34	93
Check	..	1	22	52	88
East Side of Glasshouse.					
Check	..	1	18	42	42
Sublimed sulphur ..	Dust	2	14	10	18
Ground sulphur ..	Dust	2	10	3	4
Check	..	2	10	16	9
"Shirlan A.G." ..	0·23	2	1·5	3	0
"Shirlan A.G." ..	0·47	2	0·5	1	0·5
Check	..	2	3	9	13
Lime-sulphur ..	0·083	2	4	3	18
Lime-sulphur ..	0·1	2	3	10	13
Check	..	2	16	46	28
Lime-sulphur ..	0·083+	2	6	6	6
"Agral"	0·1				
Sublimed sulphur ..	Dust	2	1·5	4	13
Check	..	2	31	37	35
Gas-sulphur ..	20+	2	16	18	25
Ground sulphur ..	80 Dust				
"Shirlan A.G." ..	0·23	2	1	3	1·5
Check	..	2	16	31	31
"Shirlan A.G." ..	0·47	2	4	3	3
Check	..	1	32	70	97

Experiment III (1936).

Only one variety—Early Market—was treated. The fungicides applied were—"Shirlan A.G." 0·23 per cent., "Shirlan A.G." 0·47 per cent., lime-sulphur 0·1 per cent., lime-sulphur 0·083 per cent., and lime-sulphur 0·083 per cent. plus "Agral" 0·1 per cent., as sprays; and sublimed sulphur, ground sulphur, and gas-sulphur 20 per cent. plus ground sulphur 80 per cent. as dusts. Applications were made at fourteen-day intervals from October 2nd to November 27th.

Results.—The crop, when examined on October 16th and 30th, showed only a trace of leaf-mould. Counts were taken on November 13th and 27th and on December 11th. Results, given in Table II, show that all treatments gave some control, although in the case of gas-sulphur plus ground sulphur it was slight. "Shirlan A.G." at either strength appears to have given the best and most consistent results, although only slightly more effective that lime-sulphur plus "Agral." The dust treatments were not as efficient as the sprays. None of the treatments caused injury to the plants.

TOMATO LEAF-MOULD, SHOWING THE PURPLISH-BROWN VELVETY LESIONS WITH WHITE MARGINS ON UNDERSIDE OF LEAF. [*Photo by H. Drake.*

Recommendations.

No treatment has yet been evolved to give satisfactory control of leaf-mould, unless accompanied by some regulation of the humidity of the glasshouse. Therefore the application of therapeutants cannot be used as a substitute for adequate ventilation.

Of the materials tested in the foregoing experiments, "Shirlan A.G." gave the most consistent results. It is recommended at a concentration of 0·3 per cent. (3 lb. to 100 gallons). Applications should be made with a pressure-pump (60 lb. pressure), and a good spray coverage obtained on both sides of the leaves.

SUMMARY.

(1) The paper covers three years' experiments on the control of tomato leaf-mould (*Cladosporium fulvum*) by the use of therapeutants.

(2) It is shown that where conditions are favourable for its development leaf-mould cannot be successfully controlled by any of the materials tested.

(3) The following is the approximate order of merit of the therapeutants used: "Shirlan A.G.," lime-sulphur plus "Agral," lime-sulphur plus colloidal sulphur, lime-sulphur, sublimed sulphur, ground sulphur, colloidal sulphur, gas-sulphur plus ground sulphur, gas-sulphur spray, and gas-sulphur dust. Of these, the first four proved sufficiently effective to warrant their use.

(4) Under the conditions of the experiments, gas-sulphur dust alone caused foliage injury.

(5) "Shirlan A.G." spray at a concentration of 0·3 per cent. gave consistently the best control of leaf-mould.

ACKNOWLEDGMENT.

We desire to record our appreciation to Messrs. Cooksley and Feretti for the use of their glasshouses, plants, and assistance given by staff, and also to the Hutt Valley Tomato-growers' Association for procuring the use of these houses for the experiments.

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A HISTORY OF THE NEW ZEALAND DAIRY INDUSTRY.

IN this book, for the first time, the principal historic details of the development of New Zealand's great dairying industry have been gathered together, the more important headings being the work of the pioneers, the founding of the dairy factories, refrigeration as applied to the dairy industry, the spread of co-operation, the establishment of the export trade, the grading system, the introduction of home-separation, the importation of dairy cattle, and legislation.

In the twenty-one chapters which comprise the four hundred pages of this work every important phase of New Zealand's dairying industry has been dealt with, while the period covered is from colonization (1840) to the end of 1935, with a supplementary summary relating to 1936. In all, some 170 dairy factories and over 300 persons are mentioned. The book is profusely illustrated, there being thirty-eight pages of illustrations comprising sixty-six pictures of personalities, dairy factories old and new, dairy stock, and general subjects. Many of the pictures appear for the first time.

A statistical appendix includes many tables not previously compiled, and presents a complete statistical survey from the earliest recorded figures to the present day.

The author of the book is Mr. H. G. Philpott, of the Dairy Division, Department of Agriculture. Mr. G. M. Valentine, Assistant Director of the Dairy Division, contributed a chapter on "Dairy Machinery and Appliances," while there is a foreword by the Hon. W. Lee Martin, Minister of Agriculture, and a preface by Mr. W. M. Singleton, Director of the Dairy Division

The book is being made available to purchasers at cost of publication, namely 15s. per copy, or 15s. 8d. post free. [N.B.—Cheques must bear exchange.]

Copies may be had from The Director-General, Department of Agriculture, Private Bag, Wellington

MOULD PENETRATION IN NEW ZEALAND CHEESE.

G. M. VALENTINE, Assistant Director, Dairy Division, Wellington.

THE development of mould on the rinds of cheese during ripening is a natural process unless special care is taken to prevent it, and mould penetration probably has been known as long as cheese has been made. Complaints regarding this defect have been received from London from time to time ever since the export of cheese commenced, but they seem to have been increasingly frequent during recent years, and particularly during the 1935–36 season.

During the period from 17th December, 1935, till 21st December, 1936, forty-seven special reports on mould penetration were received from the London officers of the Dairy Division. These represented cases in which complaints were received by them from importers, wholesalers, and retailers, and in most instances referred to mould seams which were found in the interior of the cheese when cut for sale.

In view of the quantity of cheese shipped during that period, totalling 84,494 tons, the number of complaints received was comparatively small, but it can be accepted that they did not cover all cases of mould penetration. As the defects were a source of annoyance to users and a loss of good will to New Zealand, they cannot be treated lightly, and steps must be taken to reduce them as much as possible.

The forty-seven complaints were spread over thirty-one factories as follows: Cheese from one factory was complained of on six separate occasions, one three times, nine on two occasions, and twenty once.

The various grading-stores were affected as follows: Bluff, nineteen complaints in respect of the cheese from nine factories; Wellington, seven from four; Patea, six from five; New Plymouth, five from five; Wanganui, four from two; Dunedin, three from three; Auckland, two from two; and Lyttelton, one from one.

There is no means of determining the aggregate amount of cheese affected, but the reports received seldom had any reference to more than one or two crates, and allowances for a few pounds of waste cheese. Some, however, concerned fairly large parcels, as follows: "2½ cwt. returned to warehouse"; "40 lb. lost"; "161 lb. loss on 140 crates"; "80 lb. to 90 lb. waste plus £5 allowance made"; "loss of 340 lb. on 34 crates."

LONDON REPORTS.

In most of the reports an attempt had been made to indicate the possible cause of the mould penetration, and this is dealt with by Mr. F. H. Taylor, Inspector of New Zealand Dairy Products, London, in a letter dated October, 1935, which reads in part as follows:—

> "During the past week I visited Messrs. ——'s store in London to investigate a complaint regarding mould in cheese. At the time of my visit these people had cut some three crates of cheese and from these six cheese approximately 20 lb. of pieces were laid aside as being unsuitable for their counter trade. On examination it was noticed that in some instances the mould penetration had

started fairly well down the wall, and some cracks were noticed in the rinds which would indicate that the cheese had been damaged at some stage.

"There seem to me to be two possible explanations for the frequent occurrence of this mould penetration. Firstly, I have noticed that in nearly all cases where this trouble has occurred it has been found on examination that the rims are very small. This would seem to indicate that if the cheese are made in the old type of hoop there does not seem to be sufficient curd to allow for the correct amount of pressure, and this probably causes looseness. The second explanation might be that the cheese are being damaged prior to being put into the crates. The examination of this particular cheese would seem to indicate that the walls had been bumped on a sharp corner, possibly on the shelf during turning. I can see no other reason for the cheese developing this trouble. There is the old explanation of the faulty mixing of the cold curd, but an examination of a number of these cheese would lead one to suppose that this was not the cause of the trouble, as the cheese on either side of the mould seam showed that the curd was the same and had knitted thoroughly prior to the development of the mould. I think we shall have to look to the curing-room for the explanation of the greater percentage of this trouble.

"Judging by some of the cheese which I have seen displayed in various retail grocers' shops, I am sure that we are not hearing all that could be said about this complaint. Numbers of pieces of cheese which I have seen have shown mould penetration to a greater or lesser degree, but unless they are very badly affected, or involve some considerable loss, nothing is said about the matter.

"By way of comment, it is interesting to note that Cheshire cheese which has developed this defect appears to sell at a premium. I have seen several of these displayed in shop-windows and marked as "Blue Cheshires." For some reason these are considered to be something of a luxury, whereas the slightest defect of this sort in Cheddars leads to complaints, and retail counter assistants state that they are difficult to dispose of."

Complaints received during the period mentioned have been grouped under the following headings:—

Cracked rinds	14
Cracked crowns	11
Cracks under rims	8
Mould seams (2 tops, 2 bottoms)	4
Loose crowns	5
Loose bottoms	4
Mould seams in close cheese	3
Cracked rims, ends, sides, and generally in bad condition	7

Causes of Faults.

Suggestions as to the possible cause of these faults were also made as follows:—

"Faulty crowns—curd not knitted"; "rims and walls cracked suggests cold curd"; "bad rinds and crowns—not properly

pressed." These seem to indicate either that the hoops have not been filled full enough or that the pressure on the presses had not been maintained.

"Cracked rinds" suggests lack of scalding, or cheese being in a draught or acidy, while the number of complaints of cracked crowns seems to indicate that curd has been added at dressing to build up the cheese. This method of "sizing" was actually suggested at one meeting of managers, although the more general method followed is to over-fill the hoops and cut the cheese down at dressing.

Cracks under the edges would suggest that the rim is the cause of this defect if it were not for the fact that the detached ends are not confined to the top of the cheese. They are probably the starting-point for the mould seams and the loose tops and bottoms complained of, the last two being a later stage of development of the first. It is not difficult to understand how mould which has gained access through cracks in the rim to the concave lines of slits which show across all open cheeses from top to bottom when cut in half should develop rapidly when the crown is detached from the rest of the cheese. But it is difficult to understand the detachment of an almost similar concave piece from the bottom of the cheese where these lines are almost straight, unless it be due to "huffing."

The following quotations give a possible explanation: "Loose bottom—cracked side"; "fracture one third distance up—probably jarred when green." The necessity for careful handling of the cheeses while in a green state cannot be too much stressed, as any one who has examined cheese with cracked rims is immediately impressed with the feeling that rough handling was the probable cause. This would at once suggest that defects of this class would be more common in cheese which is transported to a central curing-room while in a green condition, but a survey of the complaints received shows that only one referred to cheese handled in this way.

More difficult still is it to understand the growth of mould in close cheese free from slits: "Close cutting, but slightly moulded"; "small crack, mould vein right across cheese, close cheese with no mechanical or slitty openings—suggest mould contamination before hooping." It is accepted that mould cannot grow except in the presence of air, and the above suggests that the amount needed is very small.

Contamination from Clothing.

Mould or mould spores are present in all cheese-factories to a greater or lesser extent, but heavy contamination from the clothes of employees who have been working in the curing-room (some of which contain stocks of cheese for local sale which are heavily coated with mould) and at a later period take part in handling the curd in the vats has been suggested as a probable cause of contamination.

Cheese in bad condition at all points may be due to many causes from the making process up to final disposal, as there are quite a number of probable reasons for the development of cracks in the skin of a poorly made cheese, more especially when it is held in a poor curing-room. A survey of the curing-rooms at those factories about which a number of complaints were received has shown that most of them were poorly ventilated, and in such a condition that the growth of mould was encouraged. Extracts from reports read as follows :—

(*a*) "Previous to this curing-room being ventilated it was regarded as a very damp room, and doubtless the position in previous years was aggravated somewhat by the storage of local-market cheese, which invariably become mouldy."

(*b*) "With reference to this curing-room it is now receiving attention, and with the extra ventilation provided should assist in preventing excessive mould growth. It has always been recognized to be a very damp one."

(*c*) "This curing-room has always shown excess mould development, and the manager has undertaken to provide more ventilation."

Later—"It is now adequately ventilated and freer from mould than at any time previously."

(*d*) "This room was ventilated during the winter months, and is this year much freer from mould."

It would be unsound to attribute all cases of mould penetration to the condition of the curing-room, as it is true of both cool stores and ships that, while some are practically free from mould, others are the reverse. It can be claimed, however, that the curing-room should be so constructed and controlled that the possibility of contamination, even of cheese with defective rinds, will be reduced to a minimum.

Access of Air.

During investigations which he carried out during 1929–31 into the question of discoloration in New Zealand cheese, Mr. G. F. V. Morgan, at that time bacteriologist to the Division, showed that all cases of mould penetration were connected with a break in the rind of the cheese, which allowed the access of air. During the 1931–32 season a very large number of reports were received from London on the prevalence of discoloration in New Zealand cheese, and Mr. Morgan formed the opinion that mould penetration was probably the cause of, or had a connection with, the discoloration. Because of this belief instructions were at that time issued to all cheese instructors to pay particular attention to the finish of the cheese and the care of the curing-rooms at all factories, and these matters have since received close attention.

On 13th January, 1936, a circular letter was sent to all cheese-factory managers drawing attention to the number of complaints being received regarding mould penetration, and stressing the need

for care in handling the cheese, and proper mixing of curd carried over from one day with the following day's make before dipping.

As complaints continued to come forward from London, the question was referred to the Acting Director of the Dairy Research Institute, who suggested that the loose crowns and bottoms were possibly due to gas produced by lacto-bacilli in open cheese, and raised the question as to whether mould penetration occurred in close cheese. It was further suggested that, if the above theory was correct, the cure lay in making close cheese, and that the problem was therefore the same one as openness in general.

The question whether mould penetration was found in close cheese was referred to Mr. Taylor, and it will be noted that it is really answered by the instances already quoted in which close cheese was affected.

Under date of 23rd October, Mr. Taylor replied to this letter, and the following is a summary :—

> "Mould seams are found in both open and close cheese. Openness will make it easier for mould to spread. Cheese appeared to have huffed up at some time and allowed mould to develop in the seam. More complaints from Southland than other provinces."

It should be stated that as the result of his observations in England Mr. Robertson considers the huffing theory to be worth further investigation.

On the same date a circular letter was sent to all graders-in-charge and cheese instructors asking the former to report on the methods of handling at cool stores, and the latter to pay special attention to the handling in the factories.

Handling of Crates.

A survey of the replies received from the grading ports did not disclose any marked difference in the methods of handling. If there are any weak spots, they are more or less common to all. They are—Dropping of the third tier of crates which are lying on their sides in the railway-truck when starting to unload, and dropping the top tiers in the cool stores, which are up to six high, when breaking out a straight face in a stack when loading out. The latter seems to be the weakest spot in the chain of handling in New Zealand.

Special conditions obtain at some ports regarding shipment. Patea cheese is transhipped in Wellington, either from coastal steamer to Home steamer or from coastal steamer to Harbour Board store, and thence to Home steamer. Shipments of cheese from the Bluff during 1936 totalled 33, Wellington 81, Patea 68, New Plymouth 45, Wanganui 36, Dunedin 24, Auckland 66, and Lyttelton 24. Cheese in the Bluff cool stores would therefore have a long storage period before shipment, the crates being on the same end without turning during that time, and it has been suggested that this treatment might encourage huffing, but Wellington, which is next for the number of complaints, has the most frequent shipments. It has also been noticed that practically all the cheese about which complaints of mould penetration were received at the Bluff were waxed.

In connection with Auckland, it is perhaps worth noting that the greater portion of the cheese shipped from that port is made in factories in which the temperature of the curing-rooms is controlled by artificial refrigeration.

Points covered by instructors regarding possible causes of mould penetration deal with the need for close rinds, and mention the following points: Space not covered between bandage and cap; loose bandages caused by not pulling them up at dressing; handling of green cheese.

Time of Dressing.

A point was also raised regarding the dressing of cheese in the morning instead of the evening. This practice is said to have increased recently in order to avoid paying overtime, with the result that owing to scalding water not being available at the time when the work is being done in the morning, and the short period of pressing after it is finished, no proper rind is developed on the crown. As the general practice is to "size" or cut down the cheese at this stage the cap and bandage do not adhere to the crown, and cracking and mould penetration results.

The Dairy Research Institute could not conveniently undertake any experimental work on this subject at this stage, and with a view to getting some further information on the question of the effect of the treatment which the cheese receives during handling it was decided to take advantage of Mr. Robertson's return from London, and arrangements were made for this to be done at New Plymouth during September, 1936. The suggestion was that five crates of open cheese and five of close cheese should be purchased and put through various treatments, and be examined by cutting each cheese into two halves some months later.

Some of Mr. Robertson's comments when the suggested scheme was put before him were as follows:—

> "The amount and nature of the handling no doubt plays an important part in inducing mould-growth, but mould penetration in cheese seen in London, whether in English, Canadian, or New Zealand, was by no means confined to open cheese.
>
> "There are several types, the most common being that which gains access through cracks in the end of the cheese. Then there is the type caused by the end lifting off, and this is seen as often at the bottom as at the top of the cheese."

The ten crates of experimental cheese were received at Moturoa grading stores on 13th October, and during November a single cheese, which was received there with a crack round the lip, was purchased, as it bore indications that the end would lift off.

Commenting on this cheese, Mr. Robertson says, "Many close cheese will puff up, and the only sign of defective body is seen where the break takes place. On the other hand, many cheese with split texture also puff up, so there may be some connection between the two. The whole trouble arises when the fracture extends to the rind and allows the admission of air, as without this no mould development can take place. From what was seen in Great Britain I would not say that open cheese were any more liable to this particular defect than close cheese."

The following details give the treatment to which the cheese were subjected, and the results:—

Experiment to determine the Influence of Handling on Mould Penetration in Cheese.

Ten white cheese were purchased from a dairy company which was making close cheese. Cheese made 12th October, 1936.
Ten coloured cheese were purchased from a dairy company which was making open cheese. Cheese made 12th October, 1936.
Cheese were received at the grading-works, Moturoa, on 13th October, 1936; packed, 29th October, 1936; stacked on ends till 10th December, 1936; stacked on sides till 18th February, 1937.
Examined at Wellington, 19th April, 1937. Age approximately six months.
One cheese with a cracked lip was purchased from another dairy company on 15th November.
All cheese was forwarded to Wellington by rail on 18th February and received on 22nd February. Stacked on ends till 19th April, 1937. Treatment of cheese was as follows: Turned daily until crating on 29th October. Crates 1, 3, 5, and 7, cheese packed with bottoms to centre board; crates 2, 4, 6, 8, and 10, cheese packed with tops to centre boards.

Marks.	Treatment on Shelves and during Packing.	Treatment of Crates.	Remarks.
Group 1: Crates 1 and 2—			
Crate 1—Cheeses No. 1 white and No. 1 coloured Crate 2 Cheeses No. 2 white and No. 2 coloured	Handled carefully at all stages ..	Crates stacked on end for six weeks without turning and a further ten weeks on sides	1W No visible fractures in rind. 1C Cracked ends; one over 1 in. deep. 2W Sound rind. 2C Cracks on sides.
Cheese No. 2 (coloured) showed a bare patch when received due to inefficient dressing.			
Group 2: Crates 3 and 4—			
Crate 3—Cheeses No. 3 white and No. 3 coloured Crate 4—Cheeses No. 4 white and No. 4 coloured	Handled carefully up till crating, and then treated roughly by letting crates fall to floor	Crates stacked on end for six weeks without turning, and a further ten weeks on sides	3W Cracks on sides. 3C Small cracks on sides. 4W Good sound rinds. 4C Fracture in end.
Cheese No. 4 (coloured) had a nail puncture and also a loose cap when received.			
Group 3: Crates 5 and 6—			
Crate 5 Cheeses No. 5 white and No. 5 coloured Crate 6 Cheeses No. 6 white and No. 6 coloured	Handled carefully at all stages..	Crates stacked on end and turned carefully each week for six weeks, then stacked on sides for a further ten weeks	5W Good rinds. 5C Good rinds. 6W Small cracks in sides. 6C Small cracks in sides.

EXPERIMENT TO DETERMINE THE INFLUENCE OF HANDLING ON MOULD PENETRATION IN CHEESE—*continued.*

Marks.	Treatment on Shelves and during Packing.	Treatment of Crates.	Remarks.
Group 4 : Crates 7 and 8— Crate 7—Cheeses No 7 white and No. 7 coloured Crate 8—Cheeses No. 8 white and No. 8 coloured	Handled roughly during turning, and dropped on ends on shelves	Crates stacked on end and turned roughly each week for six weeks, then stacked on sides for a further ten weeks	7w Closer than previous lots ; very fine cracks in sides. 7c Closer than previous lots ; very fine cracks in sides ; nail in lip. 8w Closer than 7w ; long fracture in lip, apparently a cut. 8c Closer than 7c ; very small cracks in sides.
Group 5 : Crates 9 and 10— Crate 9—Cheeses No. 9 white and No. 9 coloured Crate 10—Cheeses No. 10 white and No. 10 coloured	Handled roughly and treated similarly to 7 and 8 Treated as above and dropped on floor from height of 3 ft.	Crates dropped to floor from one tier high, stacked on end for six weeks without turning, then ten weeks on sides	9w Similar to 7w. 9c Closer than 7c ; sound ends and sides. 10w Closest cheese of whole experiment ; number of large cracks in rinds. 10c Some large cracks in rinds and lip, with a strong growth of mould for a short depth only.

Crate with one cheese with cracked lip : Large number of mechanical openings ; bottom more open than top ; loose top but not completely detached from rind ; large fracture in lip ; break in rind on side ; no mould penetration.

General Observations.

There was practically no mould development on the rinds. The bottom halves of all the cheese were more open than the top halves, more particularly in the white cheese.

Ends next to centre boards were in all cases softer than the opposite end, whether the cheeses were resting on the centre board or not during the period in stacks.

Grading-points of all cheese white and coloured :—

White—Flavour, 40½ ; body, 18 ; closeness, 18½ : total 92.

Coloured—Flavour, 41 ; body, 18½ ; closeness, 18 : total 92½.

White cheese bitter, and flavour not characteristic of cheddar.

Coloured cheese more desirable cheddar flavour.

Body of white cheese not so silky as coloured.

Openness of coloured cheese was more marked than in white cheese, but was of a slitty character compared with fractures in the latter. It was more evenly distributed.

Crates 7 to 10 progressively closer than previous crates.

Rinds in all cheeses except 1C and 8W in good condition, particularly white cheese.

No mould penetration in any cheese except 10C.

Conclusions.

Rough treatment was not sufficient to cause fractures in rinds, and cheese so treated were rather closer than carefully treated cheese.

The absence of mould in 8W and the single cheese purchased indicates that the conditions under which they were held were not conducive to mould-growth. The same defects under favourable conditions for mould-growth would probably have resulted in mould penetration.

This definitely points to the necessity of improved conditions in some curing-rooms, cool stores, ships' holds, and storage warehouses, but does not suggest that rough handling is permissible.

There are a number of points which are of interest—for instance, the more open character of the bottoms than the tops. This seems to indicate that the pressure in the press is not exerted evenly throughout the whole depth of the cheese.

It is not difficult to understand why the ends of the cheese which were resting on the centre boards should be soft, but it is difficult to see why the end of the cheese in the bottom section of the same crate and not in contact with the centre board should be soft also. This has been noticed in the grading-stores in cheese held awaiting shipment.

The openings in the coloured cheese were of an entirely different character from those in the white cheese, being small slits fairly evenly spread over the cut surface. Those in the white cheese were fractures which extended from side to side of the cut surface, and would lead one to expect mould seams to develop readily if the rinds were defective and the atmosphere favourable to its growth.

That would appear to be the determining factor which decides whether mould-growth takes place or not. The shallow but heavy growth of mould in No. 10C indicates that there was no lack of mould spores in the rooms in which the cheese was held, but its absence in

8w, which had a deep cut in the edge, and in the single cheese, which had a fracture right across the cheese at the top end, indicates that it can be controlled.

Effect of Treatments.

The object of the handling to which the cheese were subjected was to indicate the effect of various treatments :—

Group 1 : Careful handling in the factory and during transport.
Group 2 : Careful handling in the factory and rough treatment during transport under ordinary stacking conditions.
Group 3 : Careful handling at all stages plus careful turning each week in store.
Group 4 : Handled roughly in factory plus rough turning each week in store.
Group 5 : Handled roughly at all stages.

All crates were stacked on their sides from 10th December, 1936, to 18th February, 1937. After arrival in Wellington they were stacked on end so that conditions in this respect would be the equivalent of grading-store conditions in New Zealand, on shipboard, and in store in Britain.

As the result of the various treatments outlined, one would have expected the latter groups to show more rind defects and more openness than the others, but such was not the case.

It is probable that had this experiment been carried out at an earlier or a later stage when moist conditions prevailed there would have been more mould growth and penetration.

The evidence available supports Mr. Robertson's statement that there are two types of mould penetration ; one which gains access through the detachment of either the crown or the bottom of the cheese and the other due to smaller fractures or cracks in the rinds, ends, or rims.

The evenness of the break in the first type gives support to the theory that it is due to huffing, as the fracture, when it takes place at the crown usually follows the concave lines which appear in all cheeses when cut in half. It can be readily believed that the factor which determines whether the top or the bottom of the cheese will become detached is the position which it occupies in the crate. It is possible that a fracture in the rim may act as an outlet for the gas which is responsible for huffing, but rough handling subsequent to huffing is the probable cause of the complete detachment of the end afterwards.

Huffing, while on the shelves, was at one time common, but it is seldom seen to-day, and there is no evidence to show the stage at which it developed in the cheese which were the subject of complaint.

Penetration of mould through smaller defects in the rind can obviously result from a number of causes such as those noted on some of the cheese in the experiment, provided the storage conditions are favourable to its growth. Its absence in these cheese is an indication that it is possible to prevent its growth, and improvement in the conditions in the curing-room suggests itself as the first point requiring attention.

On 10th February, 1937, a circular letter was sent to all cheese instructors asking for information regarding factories :—

(1) Which have built new curing-rooms ; and

(2) Which have improved the ventilation, air circulation, and humidity control in existing curing-rooms ;

Also any action taken in regard to—(*a*) The necessity for close rinds and crowns ; (*b*) clean vat-covers.

Replies indicated that thirteen new factories or curing-rooms provided with good ventilation had been built during the previous year, and that improved ventilation had been provided in thirty-one others, while humidity had also received attention. These numbers have been considerably added to during the present winter.

In his reply, Mr. J. H. Earl, Dairy Instructor, Hamilton, indicated that only five of the twenty-six curing-rooms in the Auckland District were not provided with refrigerators.

Other points dealt with were the necessity for washing and drying the shelves after the cheese are removed for packing, fumigation with sulphur and formalin, while comment was made on the use of the curing-room as a general lumber room.

(The provision of a room for the storage of bandages and capes is a noticeable feature of many of the plans of new cheese-factories recently received for approval at this office.)

Points dealt with in connection with rinds and crowns were—Care in filling the hoops and sizing at dressing to ensure adequate pressing, scalding of hoops, quality of cheese-caps, lapping of cap and bandage, oversalting of curd, and draughts playing on cheese on the shelves causing cracked rinds. These are all possible causes of defects in the rind which will give access to mould, and, though commonplace points, their inclusion indicates that they have been noted in some factories.

The course of action to be followed in the future appears to be along the lines followed in the past in regard to supervision in the factories, and as the time seemed opportune to make even greater efforts to impress these points on factory managers and directors with a view to providing improved conditions in curing-rooms, a further circular letter dated 7th July, 1937, was sent to all dairy companies manufacturing cheese in New Zealand suggesting the means to be adopted to achieve this end.

An interesting experiment has been carried out on a South Canterbury farm. On two fallowed fields in February, 1935, drill widths of carbonate of lime were sown—one at 5 cwt. per acre, two at 10 cwt., three at 15 cwt., four at 1 ton, five at 30 cwt., and six at 2 tons. Field A was sown in March, 1935, with 30 lb. perennial rye-grass and 5 lb. red clover, with 1 bushel of oats, which were fed off during winter. Field B was sown in September, 1935, with 20 lb. ordinary rye-grass and 6 lb. of red clover, with oats, which were cut for crop. The results in these two fields show remarkable differences. On field A no results from any treatment can be seen ; on field B the response of the red clover from lime is outstanding, even 5 cwt. giving a good result. The autumn sowing has formed a dominant perennial rye-grass sward. The spring sowing has formed a dominant red-clover sward. The clover has responded to the lime on field B, whereas on field A the clover content is practically non-existent.

—*Fields Division.*

TROUBLES ASSOCIATED WITH THE FEEDING OF ROOTS.

D. MARSHALL, Veterinarian, Hamilton.

IN many parts of New Zealand the use of roots is standard practice in the winter feeding of cattle, sheep, and sometimes pigs. It is recognized that mangels and turnips consist largely of water. Henry and Morrison give the composition of swedes as water 89·1 per cent., ash 1 per cent., crude protein 1·2 per cent., carbohydrate (including 1·4 fibre) 8·4 per cent., and fat 0·3 per cent. Mangels are almost identical. These foods are therefore low in protein, their chief food value consisting in the carbohydrate.

Before mangels are fed it is essential that they should be lifted and properly pitted for at least a month to six weeks in order that they may mature and certain chemical changes take place. Swedes and turnips may be lifted and pitted, or at least carted off and fed on grass paddocks. This entails considerable labour, and more often sheep or cattle are fenced on a portion at a time of the turnip crop, preferably with a good run off on to grass or rough feed.

There is discussion as to the value of roots in milk-production. In the Waikato soft turnips are valued by some farmers as a supplement during dry summer months, and are believed to keep cows milking. Their succulent nature is valuable at this time. For winter feeding, Boutfleur, of the Harper Adams College, considered roots too bulky as a feed for high-producing dairy cows. He is, of course, a great advocate of a concentrated diet. Other writers, however, consider that roots, up to a point, and properly balanced with other food, will increase milk-production. The average amount fed to dairy cows is up to 56 lb. Bullocks can be run on turnips alone, and will fatten. Dairy cows, however, whether dry and pregnant, or in milk, will not stand this treatment, and additional food is required. Apparently hay is quite a suitable supplement, as it assists amongst other things in providing fibre to allow rumination to be carried out properly.

Where a run-off is provided, this is not of much value unless a fair amount of rough feed is available. Ewes are sometimes run on turnips right up to lambing, but, while no ill results may follow, the practice is a risky one unless a good run-off with a fair amount of roughage and picking is available. Cases of ante-partum paralysis have been seen in ewes on turnips where this precaution was ignored.

In the winter feeding of pigs, roots are useful. Recent information available to the Fields Division at Ruakura indicates that the quality of bacon was improved considerably by including swedes up to 30 per cent. of the ration of pigs, compared with a ration of milk and grain only. The experiment was carried out by Professor Jesperson, of Copenhagen, and it was found that, whereas on the skim-milk grain ration alone only 5 per cent. carcasses reached first grade, pigs gaining 1·6 lb. a day, there was a steady increase in the percentage of first-grade carcasses with an increase in roots until, in the pigs getting 30 per cent. roots, 75 per cent. were graded first, though the daily rate of gain was slightly reduced to 1·1 lb. per day. Mr. Ballinger is carrying out a similar experiment at Ruakura to check results under New Zealand conditions.

It should be remembered that, owing to their low protein content, roots alone are not a sufficient food for young growing pigs or for pregnant sows, and should be balanced with a good protein supplement such as meat-meal or good-quality grain-meal.

Mortality due to Mangel Feeding.

Mr. B. C. Aston, till recently Chief Chemist to the Department, did considerable investigation of the mortality due to mangel feeding, and as far back as 1911 wrote an article on the subject in this *Journal*, dealing with mortalities in cows at that time. It was his opinion that the poisoning—for such it appears—is due to the formation of nitrites from nitrates in the stomach. The amount of nitrates present is high in certain seasons.

Two years ago mortality occurred in a farm in the Bay of Plenty. The mangels were pulled and left lying in the paddocks, not heaped or pitted, for about a month before using. Though this was the farmer's usual practice, it was evidently not sufficient for proper curing to occur. A load was carted out to in-calf cows about twice a week—about 30 lb. per cow. Mangels were put out one afternoon, and next morning eight cows were dead in the paddock. Nitrates in undue amount were present in the mangels.

Two occasions occurred more recently in which a number of deaths occurred suddenly amongst pigs being fed mangels. The deaths suggested poisoning, but analysis for the common poisons were quite negative, while analysis of mangels revealed nitrates present in more than normal amount. It should, therefore, be realized by farmers that, while mangels are an excellent winter foodstuff, there is risk in their use unless they are properly matured by pitting for some weeks.

One point to be noted in the feeding of any variety of turnip to the dairy cow is that these may give the milk a very strong turnipy odour and taste. This is particularly evident if cows are running all day on turnips and eating shaws and all. It is due to elimination of certain volatile substances by way of milk. It can be largely avoided by feeding the turnips, minus the tops, immediately after milking, and to a less extent by letting the tops wilt before feeding. It is almost unescapable if cows are on turnips all day.

Redwater.

In the United States of America, South Africa, Queensland, parts of Britain, and Ireland, a type of redwater occurs due to the presence in the blood of a small parasite which attacks and breaks down the red blood cells. It is transmitted by ticks. However, there occurs also in Britain a form of redwater not known to be associated with parasites and called parturient redwater, because of its common occurrence after calving. It is apparently this form which occurs in New Zealand. So far no parasite has been detected in the blood, and also it occurs in parts of the country where ticks are not found. It is believed to be dietetic in origin. It is common in Otago and Southland, often appearing about ten days after calving, and nearly always associated with root feeding. A common history is that cows have been on roots and hay and for some reason the hay ration had been omitted, though the usual supply of roots was eaten. Redwater appears in about twenty-four hours. In the South Auckland district, it has been seen both in pregnant

dry cows and milking-cows under above conditions, or where running on turnips alone, with a poor run-off. It is also sometimes seen about October in the Bay of Plenty in cows on grass.

Symptoms.—The urine, if seen, is characteristic, and is any shade from bright red to almost black coffee colour. The mucous membranes lining, eyelids, mouth, nostrils, and vagina are pale and blanched. The heart-beat is loud and the impulse easily felt at side of chest. Cow may continue to feed and milk for a day or two, and, if early symptoms are overlooked, death occurs with apparent suddenness. However, there is usually a period of extreme depression, weakness, and loss of appetite for a day or two before death. Post-mortem will usually show black urine in bladder, and kidneys dark, almost black.

Treatment.—Owing to oxygen shortage and heart weakness the animal is in a critical state, and should not be unnecessarily driven or hustled. Drenching also should be carried out with great care to avoid pneumonia, which is a common result. Cow refuses to swallow, and the drench enters lungs instead of stomach.

Salt is an old and usually effective remedy. Give ¾ lb. to 1 lb. properly dissolved in a quart of tepid water, with 1 tablespoon of baking-soda and 1 lb. molasses, carefully as a drench. Rug well, leave quiet, and if animal is still feeding, give plenty of hay sprinkled with molasses. If animal is off feed, stimulants may be given, such as 1 teaspoon of powdered nux vomica and 1 oz. of vegetable turpentine in a bottle of milk, or a bottle of beer. If a case of redwater appears, immediately adjust feeding for balance of cows, reducing turnips and giving adequate hay.

Turnip Sickness—Turnip Founder.

These names are loosely given to a derangement occurring in dairy cows very often dry and pregnant, under same conditions as produce redwater—unlimited roots with little or no supplement.

Symptoms.—There may be marked stiffness suggesting rheumatism, or the gait of a foundered horse. The animal may stagger. In more severe cases, cow may go down and have difficulty in rising. The expression is dull, the pulse weak, appetite gone. There is a desire to drink, and excessive quantities of fluid make the trouble worse. The paunch is frequently distended with fluid and fragments of turnip, and the animal has a full appearance.

Treatment.—This should be prompt. Two tablespoons each of common salt, ginger, and baking-soda, with 1 lb. molasses, should be given at once. This may be all that is required. Stop roots for a day or two and feed hay. In more severe cases nux vomica, soda, and molasses should be given in repeated doses (1 teaspoon powdered nux vomica, 1 tablespoon of baking-soda, 1 lb. molasses, twice a day). As with redwater, immediately correct feeding for balance of herd.

Choke.

This is more likely to occur in stall-fed animals than in the field. A portion of a root slips over the throat and becomes lodged in gullet, very often about the middle of the neck. The animal coughs, slobbers, and stops feeding. The immediate danger is that the gullet is impacted, gas is unable to escape and bloating occurs, threatening suffocation. It is sometimes, therefore, advisable to use trocar and canula, and leave latter in position in the left flank. In some cases the cow will then

herself get rid of the obstruction. If just at back of throat, it may be possible to reach the obstruction by putting a hand into the mouth, remembering the risk of getting one's fingers chewed.

A probang may be cautiously used, if available, or failing that a piece of flexible branch or whiphandle, with a piece of cloth in the shape of a knob securely placed to the end, and the whole well greased. The cow's head should be extended in line with body and securely held by a man on each side before this is attempted. On no account try to push down a rigid stick such as a broomhandle or a piece of steel bar, as the gullet will certainly be punctured.

CITRUS INDUSTRY.

THE area devoted to both orange and lemon culture in the Dominion is steadily increasing. In comparing the figures set out below with those which appeared in the *New Zealand Journal of Agriculture*, Vol. 53, No. 1, page 49 (July, 1936), it will be seen that during the past twelve months, while there has been a decrease of forty registered growers, there has been a gain of 10,246 citrus trees.

From the orchard-registration records the following Table 1, showing the number of registered citrus-growers in the Dominion classified in districts according to size of orchard, as at 1st October, 1936, has been prepared:—

Table 1.—Showing the Number of Registered Citrus-growers in the Dominion classified in Districts according to Size of Orchard as at 1st October, 1936.

Group, Number of Trees ..	1–50 Trees.		51–350 Trees.		351–1,000 Trees.		Over 1,000 Trees.		Total of Trees.
District.	Number of Growers	Number of Trees.	Number of Growers	Number of Trees.	Number of Growers	Number of Trees.	Number of Growers	Number of Trees.	
Whangarei	200	2,384	63	9,872	40	20,400	3	6,553	39,209
Auckland	739	10,762	261	32,473	19	9,231	1	1,350	53,816
Hamilton	151	869	6	551	..	..	..	..	1,420
Tauranga	246	2,752	99	15,693	20	10,320	2	3,322	32,087
Gisborne	183	1,816	22	3,006	1	420	..	..	5,242
Hastings	201	1,845	19	2,276	..	..	..	..	4,121
Masterton	13	70	..	..	..	..	..	..	70
Palmerston North ..	218	1,204	3	267	..	..	..	..	1,471
Wellington ..	24	141	..	..	..	..	..	..	141
Nelson	56	381	14	1,559	1	450	..	..	2,390
Mapua	36	319	7	520	..	..	..	..	839
Motueka	66	385	6	563	..	..	..	..	948
Blenheim	93	369	..	..	..	..	..	..	369
Christchurch ..	23	51	..	..	..	..	..	..	51
Dunedin	2	13	..	..	..	..	..	..	13
Trees	..	23,361	..	66,780	..	40,821	..	11,225	142,187
Growers	2,251	..	500	..	81	..	6	..	2,838
Percentage of total number of growers	79·32	..	17·62	..	2·85	..	0·21	..	..

Table 2.—Lemon and Orange Trees in Registered Orchards as at 31st October in the Years 1934, 1935, and 1936.

Kind of Fruit.	1934.	1935.	1936.	Percentage Increase 1936 over 1934.
Lemons	85,973	91,032	96,034	11·7
Oranges	37,399	40,909	46,153	23·4
Totals	123,372	131,941	142,187	15·3

—*W. K. Dallas, Acting Assistant Director of the Horticulture Division.*

SURVEY OF CERTAIN CROP DISEASES IN CANTERBURY AND NORTH OTAGO.

I. D. Blair, Canterbury Agricultural College, Lincoln.

With a grant of the Plant Research Committee, a crop-disease survey was made from December to March, 1936-37. The area covered included all county areas from Amuri in the north to Waitaki in the south, and the distance travelled was 2,500 miles. As this was the first complete survey of such a nature it was decided that primarily it should be in the form of a reconnaissance. Undoubtedly the problems of determining the factors which predispose crops to certain diseases require investigation, but it was considered that first of all a knowledge of the occurrence, distribution, and extent of infection was necessary. Following upon this definition of the areas, if any, where certain diseases were widespread and severe, one would then be able to determine which aspects of the disease problem might require further study. Thus throughout the course of the survey the crops were merely inspected and estimates made of the extent of infection of certain diseases. Little attention was given at this stage to an examination of possible factors which may have been associated with a severe or slight infection.

In view of the time of the year during which the survey was made the only diseases studied were such as occur in maturing crops of wheat, oats, barley, peas, lucerne, red clover, white clover, cocksfoot, and rye-grass.

The following is a summary of the position concerning the cereal crops alone, the complete details of which are published elsewhere :—

Oats.

(1) *The Smut Diseases.*

The position with regard to the occurrence of loose smut (*Ustilago avenae*) and covered smut (*Ustilago Kolleri* and *U. laevis*) in oats is shown in the following table. The percentage of smut infection was determined by counting ten five-yard coulter samples at random throughout the field, except where it was obvious that there was no more than a "trace" of infection :—

Table I.—A Summary of the Degree of Smut Infection in Oats.

——	Algerians.	Gartons.	Other Varieties.
Total number of crops examined ..	121	69	30
Unaffected (per cent.)	60	63	47
"Trace" (per cent.)	20	27	50
"Severe" infection (1–20%), (per cent.)	20	10	13

This table is a summary of a table in which the detailed distribution of the smut diseases is recorded.

During the survey it was found that covered smut of oats (*Ustilago Kolleri*) was much less common than loose smut (*Ustilago avenae*).

These diseases are widely distributed, but no more severe in one district than in another. From Table I it will be observed that, according to variety, from 37 per cent. to 63 per cent. of the oat crops were affected with smut and from 10 per cent. to 20 per cent. were severely infected. From the figures given above, Algerians appear to have been more severely affected than Gartons. This is believed not to be a varietal difference, but to be due to the common practice of sowing unpickled Algerian seed, primarily for green feed. Later such crops may be allowed to go to seed and the infection with smut is then apparent.

The severest infections occurred with lines of unpickled seed. Most of the unaffected crops had been sown with disinfected or pickled seed, but instances have been recorded of smut-free crops grown from unpickled seed. Mr. J. C. Neill in 1926 concluded that oat smut destroyed 600,000 bushels in the South Island, an estimated loss of £135,000.

Apparently the disease has been reduced since 1926 as a result of the greater use of seed disinfectants since then. Thirty-five per cent. of the growers visited during this survey did not pickle their seed-oats, and it is those crops which are acting as centres of infection from which the diseases spread. It appears that there is a possibility of freeing oats from infection with smut if all growers pickle the seed.

In the following table an indication is given of the proportions of various seed pickles used for oats in the area under investigation :—

Table II.—The Proportions of various Disinfectants used with Oats.

Seed Treatment used.	Number of Growers.	Percentage.
No treatment	96	35·0
Ceresan	50	18·2
Agrosan	30	10·9
Copper carbonate ..	16	5·8
Clark's	24	8·7
Formalin	36	13·1
Bluestone	22	8·0

(2) *Rust in Oats.*

Leaf-rust (Puccinia coronota) was widespread, but the disease was not "severe," except in three localities—viz., Kowai, Ashburton–Methven, and Ashburton Main.

Stem-rust (Puccinia graminis avenae) seemed to be more "severe" in effect where it occurred, but it was not so widely distributed as leaf-rust early or late in the season. It was "severe" in spring-sown crops of oats throughout all districts. Wherever leaf-rust was found as a heavy infection, stem-rust was also "severe." Thus in the Kowai County, particularly at Amberley and in Ashburton Main and Ashburton–Methven, there were heavy infestations of both rusts early in December. In all other districts stem-rust was not reported until late in January, and then only as a "trace" or "moderate" infection. In view of the heavy leaf-rust infection in the three districts mentioned and the early attacks of stem-rust there, such areas appear to have

been centres of infection this year. Whether or not they or other districts may be recorded as rust-susceptible areas can only be proved by observation in succeeding years.

Further observations on the occurrence of rust will be made in connection with barley and wheat.

(3) *Other Disease Conditions in Oats.*

Mildew was not present this year in any of the 220 oat crops examined during December and March.

Red Leaf.—The vivid red colour of the lower leaves of oats draws frequent comment each year. In America Sprague found that the condition was most prevalent in poorly drained soils where there was excessive water and a decreased oxygen-supply. Unduly luxuriant top growth as a result of the lengthy vegetation season is also apt to induce lead-reddening.

This condition appears to be due to some physiological cause. During this survey it was found in all districts and in all varieties but more severely in Algerian oats. Although it was more common in soils which seemed to be poorly drained and was characteristic of autumn-sown crops, some severe attacks have been recorded in crops grown on the very best open-textured soils. It was also frequent on light and sandy soils, in which case excess of water and poor drainage would not be associated factors. The cause and effect of this condition require some investigation.

Blindness in Oats.—All crops were affected in some degree with a condition characterized by sterility and whiteness of some of the spikelets. O'Brien and Prentice describe such a condition in Scotland as being due to attack of *Helminthosporium avenae*, which also causes death of seedlings. This condition in oats requires investigation under New Zealand conditions, for in some instances the sterility of the ears was as great as 75 per cent. Usually the affected ears are distributed throughout the field, but in three instances patches of the crop with heavy infestation of blind ears were observed.

Barley.

The barley crops in the area under survey were confined to three districts. The position has been examined under the heading of "district" rather than "disease."

(1) In the North Canterbury district only one crop of Spratt-Archer Barley was examined. It was "severely" affected with leaf-stripe (*Helminthosporium gramineum*). There was only a trace of leaf-rust (*Puccinia anomala*) and mildew (*Erysiphe graminis hordeae*).

(2) In the Ellesmere barley-growing district ten crops of Spratt-Archer, four of Chevalier, and two of Cape Barley were examined. All these crops were free from loose smut (*Ustilago nuda*). The hot-water seed treatment introduced by the Canterbury (New Zealand) Seed Co. has evidently resulted in this disease being controlled completely. The position with barley is much more satisfactory than will be shown to be the case with the wheat crops. In Ellesmere barley crops grown from seed, four years removed from the hot-water treatment, were found to be still free from loose smut. There was no evidence of covered smut (*Ustilago hordeae*) in these crops, the seed of which is treated each year with Ceresan.

Leaf-rust was widespread throughout Ellesmere, all the crops and varieties being infected in "moderate" or "severe" degree. On the other hand, stem-rust (*Puccinia graminis hordeae*) was rare and occurred only in "traces," as revealed by an inspection six weeks after the estimates were made of leaf-rust. During this season there was no correlation between the degree of severity or the occurrence of leaf-rust and stem-rust in barley as has been suggested in the case of the two rusts of oats.

The ten Spratt-Archer crops were affected with leaf-stripe, five of them revealing "severe" infection. The four Chevalier crops were much less affected and showed only a "trace" of stripe. Cape Barley also revealed only a "trace." The stripe disease is apparently reduced by the seed hot-water treatment. There was no sign of the disease in the crops directly removed from the treatment, while crops grown from seed once or twice removed were the ones which showed a "trace" of stripe.

Mildew was present in "traces" in all varieties.

(3) In the Waimate barley-growing district smut was more common. This was especially so in the six crops of Cape Barley, all of which showed a "trace" of covered and loose smut. In the Chevalier variety the two smuts were recorded as "traces" in two of the four crops inspected. Few lines of barley-seed in this district have been hot-water treated during the past three years. Leaf-rust in this district was not so severe in the barley crops as in Ellesmere. There was no more than a "trace" of infection in about 20 per cent. of all the crops of barley. There were "moderate" infections with leaf-stripe, while mildew was not recorded in any of the crops.

Wheat.

(1) *Loose Smut (Ustilago tritici).*

"Traces" of loose smut were found in all districts. Estimates of infection were determined in the same manner as in the case of smut in oats. An infection over 0·4 per cent. is considered "severe" though the actual loss in yield resulting from such an infection might not be noticeable. On this basis the extent of "severe" infection in the varieties was determined as follows:—

Tuscan	9·4 per cent.	Garnet ..	20·0 per cent.
Dreadnought ..	5·4 per cent.	Cross 7 ..	22·0 per cent.
Velvet	11·5 per cent.		

This information is derived from a detailed table of the distribution and degree of loose-smut infection which is too lengthy to be published in this summary.

Estimates have been made also of the percentages of crops inspected which showed at least some degree of loose-smut infection. Over all the districts there was no infection whatever in the Hunters variety, but with the other varieties the following are the percentages of crops which were infected in some degree with loose smut:—

Cross 7	95·0 per cent.	Velvet ..	46·0 per cent.
Dreadnought ..	85·0 per cent.	Marquis ..	30·0 per cent.
Garnet	70·0 per cent.	Jumbuck ..	20·0 per cent.
Tuscan	58·0 per cent.		

From these figures a greater proportion of the Cross 7 crops were infected than any other variety, while the proportion of Jumbuck crops

infected was lower than any other variety apart from Hunters. A considerable number of farmers are still under the impression that loose smut may be controlled by external seed-disinfection. They look upon the presence or absence of loose smut in the growing crop as an indication of the efficiency of the various seed steeps and dusts which have been used.

It seems that much more wheat should be hot-water treated to control loose smut. The practice of growing "home" seed, which is slightly infected, for years on end favours the spread or persistence of this disease. The length of time the treatment remains effective as a control seems to vary. In the case of Tuscan some lines four years removed from hot-water have been found to be quite free from the disease, while others become infected in the first year after treatment. Cross 7 is evidently more susceptible to loose smut than Tuscan, and the effectiveness of the hot-water treatment is not very lasting in the former variety. The extent of loose-smut infection has varied with the district. In Amuri and Waipara the infection figures were lower than in any other of the counties—*e.g.*, the percentages of the Tuscan crops in these two districts which were affected with loose smut were 25 per cent. and 14 per cent. respectively. These figures are compared with 87 per cent. infection in this variety in Geraldine, 78 per cent. in the Wakanui district of Ashburton, and 78 per cent. in the Levels County. In America loose smut of wheat or barley rarely occurs severely in the Pacific Coast States or in areas of that Continent where the relative humidity of the air is low at the time of flowering of these cereal crops. The low infection of loose smut in Amuri and Waipara, which are considered to be dry areas during November, supports the American experience that damp and humid weather at *flowering-time* is the only climatic factor favouring the spread of loose smut.

(2) *Covered or Stinking Smut of Wheat (Ustilago levis).*

It is possible that covered smut of wheat is to-day a disease of little importance throughout the wheatgrowing districts. The practice of seed-pickling wheat seems to have eliminated this disease. This opinion has been formed as a result of discussions with grain-merchants who handle large quantities of grain each year.

Dalgety and Co., Christchurch, during the past five years have had a number of infected lines, but the degree of infection was always very low. About five years ago the most severely infected sample was received containing 10 per cent. of diseased grain. The disease has varied with season and the type of land. In some seasons it is centred in the foothill districts—*e.g.*, Hororata, Oxford, Springfield. At other times Southbridge, Darfield, Dunsandel, and Chertsey have been areas from which numbers of infected lines have been received. Tuscan is the variety which has been most affected. It is concluded that over the past twenty years there has been a marked decrease in the amount of smutted wheat and barley due to (1) the fact that farmers change their seed more often and use certified seed; (2) the increased use of smut-controllers such as Ceresan and Agrosan.

Canterbury Roller Flour Mills, Ashburton, receive samples of wheat each year showing traces of stinking smut. Pearl is the variety in which the trouble is most pronounced. Ashburton is not affected to any extent, smut occurring in isolated cases through carelessness in pickling or absence of dressing of any kind.

Wright, Stephenson, and Co., Oamaru, in the past five years have seen very few lines of wheat affected and have not been able to trace it in barley during that time. It has occurred principally in Dreadnought and Hunters. Since the treatment of wheat with Agrosan and Ceresan, smut has become insignificant. It is believed that where grain is stacked before threshing the ball smut is readily blown out in the threshing and not broken up, causing infection of the whole sample.

Proteena Milling Co., Ashburton.—Smut-infected lines received from Hinds, Laghmor, and Flemington. It is considered that the damage is slight, and infection has steadily diminished during the past ten years.

Fraser and Co., Dunedin.—The disease is not so prevalent as twenty years ago, when it was particularly severe in the Taieri district. Tuscan has been the most widely affected variety.

Canterbury Farmers' Co-operative Association, Ltd., Geraldine.—During seasons 1932–34 several affected lines were received, all Tuscan or Hunters. The worst cases were from Orari where farmers grew seed of their own saving which had been affected previously. It is considered that the consistent use of Ceresan is a definite deterrent.

Turnbull and Co.—During the past five years there has been a gradual decrease in the quantity of wheat affected. During 1935–36 no diseased lines were obtained.

From the above it is apparent that the position with regard to the externally borne smut-disease of wheat is much more satisfactory than has been indicated in the case of oats. But even though ball smut is eliminated from wheat it is wise to continue using the new organic mercury dust on account of the improved yields that are secured as a result of their use. Very few farmers use untreated wheat-seed. The following table shows the present position concerning the practice of pickling seed wheat. The figures given were derived from a questionnaire of 236 farmers in the area surveyed.

Table V.—The Use of Seed Disinfectants with Wheat.

Ceresan	30·0 per cent.	Clark's	15·2 per cent.
Agrosan	18·5 per cent.	Formalin	16·4 per cent.
Copper carbonate ..	9·0 per cent.	Bluestone	10·7 per cent.

Total dry dusts, 54·5 per cent. Total wet pickled, 45·5 per cent.

Ceresan and Agrosan are becoming very popular. Wet pickles are certainly being replaced and less of these are being used.

(3) *Mildew of Wheat (Erysiphe graminis tritici).*

Mildew has been found in all districts, but during this year seems to have been a disease which caused little damage to crops. The disease is not at all characteristic of the wetter districts as is generally believed. In the Waitaki County, where very dry conditions were experienced all through the past growing season, mildew in wheat was common. The severest attacks occur in dense crops on heavy land, but the disease has been recorded frequently on drier soils where the crops are thin and open. An estimate of the varietal differences was obtained in which the mean percentage of crops infected over the area investigated was calculated as follows :—

Tuscan ..	57·8 per cent.	Jumbuck ..	29·0 per cent.
Hunters ..	60·8 per cent.	Dreadnought ..	30·6 per cent.
Cross 7 ..	39·3 per cent.	Velvet and Pearl	57·0 per cent.

In certain areas Cross 7 has exhibited a degree of resistance to mildew compared with other varieties. In three fields in particular—one in Waitaki, one in Malvern, and one in Ellesmere—Cross 7 and Tuscan had been drilled in two halves of the same field. In each of these cases the Cross 7 was quite unaffected, while the Tuscan in the other half of these fields revealed " moderate " infection. The difference between Dreadnought and Tuscan in the Waimate district was also notable. In this district mildew was rarely found even in traces in the Dreadnought variety. In all districts Hunters exhibited the greatest susceptibility to mildew, although Jumbuck often showed mildew infection of the green ears, which was rarely noticed with the other varieties.

(4) *Take-all of Wheat.*

In general, the term " take-all " has been used to describe a number of disease conditions. Strawbreak, whiteheads, and spring-yellows (a phase of foot-rot in which the plants are stunted as a result of fungus attack of the roots) have all been attributed to take-all. The true take-all disease caused by *Ophiobolus graminis* is characterized mainly by the presence of circular patches of stunted plants. The tillers of affected plants are covered with a black discoloration at the base. As Table VI shows, this phase of the disease was not recorded very frequently during the course of this survey.

Table VI.—The Occurrence of Take-all in Wheat.

Tuscan.		Hunters.	
Severe.	Trace.	Severe.	Trace.
1 crop (Springs). 1 crop (Kaiapoi). 1 crop (Amuri).	2 crops (Springs). 1 crop (Kaiapoi). 1 crop (Rangiora West). 2 crops (Levels).	1 crop (Springs). 1 crop (Kaiapoi). 1 crop (Rangiora East). 1 crop (Rangiora West).	1 crop (Rangiora East). 1 crop Waipara.
Garnet: 1 crop (trace), (Ashburton–Wakanui).			
Velvet: 1 crop (trace), (Waipara).			

In some districts during the past season, particularly in Rangiora East, Kaiapoi, and Waitaki, the presence of large numbers of bleached, sterile ears before ripening has caused concern among growers. Many of these attacks of whiteheads and strawbreak are considered to have been due to late attack by *Ophiobolus graminis*, which usually causes the stunted condition in autumn-sown wheat. It has been concluded that a number of whitehead conditions have occurred due to the following causes :—

(1) *Drought.*—In Waitaki most of the bleached, sterile ears were most likely due to this cause.

(2) Mechanical fracture of the tillers by insects, particularly weevil and hessian fly. The latter pest has been more prevalent than usual during the past season, one crop in Ellesmere showing at least 50 per cent. loss of tillers due to fracture caused by hessian fly.

(3) Whiteheads associated with a late spread of infection and attack by the take-all organism (*Ophiobolus graminis*).

(4) Whiteheads due to the rotting of the base of the tillers through attack by foot-rotting fungi (*Fusarium* spp.).

(5) *Diseased Ear Conditions in Wheat.*

Brown Chaff.—Cross 7 crops were affected generally with a condition characterized by brownish-black glumes and a black discoloration of the stem just below the ear. This was recorded rarely on other varieties. Work in America has shown that brown or black chaff may be due to bacteria (*Bacterium atrofaciens*), to fungi (*Alternaria* spp.), or the cause may be physiological in nature. In the crops examined during the survey the condition appeared to have no adverse effect upon the growth of the plants.

Wheat Scab.—At harvest-time there may be found a number of plants the heads of which are compressed, with tight and discoloured chaff. The spikelets are usually sterile or any grain formed is bleached and shrunken. During this survey such attacks of scab were never found in any degree. Traces were recorded in crops throughout all districts.

Blackheads.—Affected ears become grey-black in colour at maturity and are covered with spots of a sooty-black mould. The condition spreads rapidly while the crop is standing in stook, especially during a wet harvest. This disease has been shown by F. T. Bennett to be due to the organism *Cladosporium herbarum*, a fungus which develops mainly on mature crops during damp seasons and which is not directly parasitic, but spreads on plants which have been weakened by other causes.

During the harvest of 1937 this blackheads condition was reported frequently throughout North Canterbury. A severe storm early in December, 1936, caused many crops to lodge, and such damaged crops later revealed heavy infestation with *Cladosporium herbarum*, especially during the following January and February, when further wet conditions prevailed.

(6) *Rust in Wheat.*

The most widespread leaf-rust (*Puccinia elymi*) infections were recorded in Kowai, Malvern, and in the three Ashburton districts—Methven, Main, and Wakanui. Amuri and Waipara were almost free of leaf-rust infection. In no case during this season was leaf-rust so severe as to cause significant damage to crops. Differences in varietal infection have been calculated from the tables of the occurrence and degree of infection which have been prepared. From these tables the average infections of the varieties over all the districts were as follows:—

Tuscan ..	61 per cent.	Velvet ..	65 per cent.
Jumbuck ..	66 per cent.	Cross 7 ..	64 per cent.
Hunters ..	60 per cent.	Garnet ..	63 per cent.

From the information which has been obtained there seems to be little difference in the varieties grown at the present time in respect to the extent of leaf-rust infection.

At the time of making the leaf-rust survey (December, 1936) little stem-rust (*Puccinia graminis tritici*) was noticed. At the end of January, 1937, all North Canterbury districts were inspected again. It was found that where leaf-rust had been recorded as "severe" during the first inspection—*e.g.*, Kowai, Malvern, and the three Ashburton areas—stem-rust was also present in the crops. Only in these districts were there any crops severely infected with stem-rust.

SEASONAL NOTES.

THE FARM.

The Coming Month.

GIVEN favourable weather, farmers as a rule are very busy during September. Indeed farmers who are not faced with more work than they can cope with conveniently in September either are particularly fortunate in having their work well forward, or, as is more likely, are not giving due attention to all the tasks that should be carried out. Successful farmers, while always alert to make the best possible use of all available time in September, do not allow their zeal in this respect to lead them into the error of carrying out cultivation work when the land is too wet—more harm than good readily results from working those soils which are at all heavy in texture when they are so wet that glazed furrows are produced in ploughing and that the soil clings to implements. There are in New Zealand extensive areas of open sandy soils which may be cultivated without harm to their texture when they are markedly wet, but, on the other hand, much of the land that is used for arable cropping suffers substantially if cultivated when in such an undesirably wet condition that it does not tend to crumble under the action of suitable implements. One immediate result of working overwet heavy soils is the appearance of clods when drying takes place, and it is usually both difficult and costly to reduce clods to a good tilth for cropping.

Provision of Special Feed.

The level of live-stock production that is to be attained both in the coming season and in the following one will be determined to a considerable extent by the manner in which farmers make provision of special forage for use during periods of scant pasture-growth. An important matter that deserves attention because of the frequency with which there is neglect in regard to it lies in the fact that pastures commonly fail as a direct source of feed for dairy cows much earlier in the summer than seems commonly thought to be the case; while many farmers devote all their attention to remedying February feeding weaknesses, actually pastures often begin to prove insufficient as early in the season as Christmas. Hence there arises a midsummer period of inadequate feeding to which little attention is given, but which is reflected in an unduly rapid decline in butterfat-production.

Feed of a highly digestible non-woody character is required at this period. Young green lucerne following a first cut of the crop removed in good time, the leafy grass aftermath on a paddock from which silage was obtained at a suitably early date, and soft turnips of a quickly maturing type sown early are three sources of forage which may be successfully utilized in this connection. In planning the provision of special summer feed it is well to bear in mind that the season may be better than the average one, and that when it is so it is in the interest of economy of feed to be able to convert any surplus into hay or silage, and this it is impossible to do if the summer surplus consists entirely of such crops as rape and soft turnips.

A second matter calling for more attention than it receives is that the most marked feature of the normal provision of summer feed is its deficiency, not in quantity, but in quality: the stock often are given access to plenty of feed of a sort which is not the one that they particularly require. The three types of feed just mentioned—leafy lucerne, leafy grassland aftermath, and soft turnips—provide summer rations of suitable quality for dairy stock.

Feeding of Sidelines.

In planning the special cropping for the season provision should be made to meet the requirements not only of the main class of stock on the farm, but also of subsidiary classes such as pigs and poultry, on dairy-farms, and these together with cows on those farms on which grain or sheep are the main consideration. Many farms on which dairy cows, pigs, and poultry are sidelines obtain very poor financial results from these sidelines because of the poor feeding of the sideline live-stock. The present season of the year is the one in which to initiate steps to rectify this common weakness.

For use in the winter period mangels, carrots, chou moellier, swedes, and turnips are all suitable. Except in the more severe and southern districts mangels give outstanding results when accorded good fertility and good cultivation. They are markedly reliable, being practically free from attacks of any serious disease or pest; they can withstand dry periods comparatively well, and under suitable culture their total yield of nutriment per acre is very high. Because of these facts they are specially advisable on costly fertile land, and they should be grown more extensively than it has been customary to grow them. As they require considerable attention, they should be located preferably in a position convenient to the homestead, where they are more likely to receive the weeding and cultivation that is essential to success than if they are grown in an out-of-the-way situation.

As a rule swedes and turnips may suitably be grown instead of mangels when the farming is of a more extensive type, so that the standard of crop culture necessarily tends to be lower. Carrots are suited to free soils on which, as Taranaki results in particular show, exceptionally good yields can be obtained without an unduly heavy outlay of labour. With full justification chou moellier continues to be popular, and probably to grow in popularity for use on ground which is naturally fertile or which has been made so. Chou moellier is especially suitable on land which is likely to be so wet at the time of feeding-off as to make the use of swedes wasteful. Chou moellier is also very suitable when club-root is known or expected to occur in the land to be cropped. Chou moellier though not immune to club-root is so resistant to it that good yields of chou moellier are obtained when swedes and turnips fail because of club-root infection.

Lucerne should be grown to a much greater extent than it now is. While profitable results from lucerne are being obtained over a wide range of conditions of soil and climate, the most highly productive crops are, as a rule, on distinctly fertile soils. A permanent vigorous crop of lucerne is of such great value that a fertile area should indeed be allotted to it. Poorly drained conditions are to be avoided for lucerne. Much information about lucerne culture is contained in Bulletin 155, obtainable free by applying to the Department of Agriculture. The success which attends the establishment of lucerne depends to a large extent upon the initial work. The initial steps in lucerne-growing should be based on the latest knowledge available, which enables many of the failures that characterized past efforts with lucerne to be avoided.

General Work with Crops.

Preparatory cultivation for both mangels and lucerne should be commenced soon, if it has not been started already. If at this stage it is proposed to plough old pasture for either of these crops, one deep ploughing will almost certainly give best results provided the furrows are well turned over so as to bury completely the surface layer which usually

contains a big population of weeds or their seeds; these, if brought to the surface again by a second ploughing, would be likely to give trouble in the following crops.

Land for the potato crop which was skim-ploughed in the autumn should be ploughed deeply about September in preparation for the later cultivation needed to give a suitable seed-bed. In preparing the seed-bed it should be kept in mind that the potato thrives in a loose rather than in a compacted soil.

When cereal-sowing has been done the implements may suitably be kept at work on land in preparation for rape, chou moellier, and root crops. By cultivating such land in good time one most readily secures the type of seed-bed which is required—that is, fine from the bottom upwards.

It is often advisable to close up lucerne areas in September in order to obtain an early cut. An early cut is of twofold value: it removes plants which invade the lucerne to its detriment in the spring, and which do not appear prominently in subsequent growth during the season, and it gives much probability of an additional cut each year.

Fields for Ensilage and Hay.

Pastures intended for haymaking and ensilage should be grazed off evenly and closed up as soon as they can be spared from grazing. Early closing of such fields is advisable, because it tends to lead to early mowing, which in its turn gives greater probability of a good aftermath that is generally very useful when the dry summer weather makes its effect felt. A top-dressing with superphosphate at closing-time of fields intended for ensilage or haymaking is often advisable especially in the case of fields not recently top-dressed. All material such as wire, timber, &c., likely to cause delays or breakages in mowing should be removed carefully from the fields prior to closing them.

Utilization of Feed.

Cows, during the early part of their milking-season, require feed relatively rich in protein; protein is required for the production of milk which contains proteins. Hay or silage made from pasture-growth that was at the flowering-stage or a more mature stage when mown is likely to be of low protein content unless clover was especially abundant in the herbage. The darker the colour of the silage the lower is likely to be its content of digestible protein, and it is the content of digestible protein which really matters—dark silage results usually from high temperatures during the ensiling process, and as the result of such high temperatures digestible protein tends to be turned into an indigestible condition. Short leafy pasture-growth is relatively rich in protein—in fact, in some circumstances it may be excessively rich—but often in September the available supplies of it are insufficient to meet the needs of the herd. If it becomes necessary because of this to make hay or silage the main constituent of the diet of the herd, then it should be borne in mind that well-made clover and lucerne hays are relatively rich in protein. Failing such hays, silage or hay made from the leafiest pasture (if rich in clover so much the better) should be kept for use at this period. If the grass-supply is poor and hay and silage in unduly scant supply, it may quite well prove profitable to feed milking-animals some concentrates which are rich in protein, such as linseed cake, oats, or bran. If "bloating" occurs in cows grazing on short leafy pastures, the feeding of hay or silage is likely to be of value in lessening the trouble.

Seasonable Work with Pastures.

Whether top-dressing of established pastures in September is likely to be profitable depends to some extent on particular circumstances. If there is promise of an ample supply of growth for all requirements up to Christmas, including ensilage and haymaking, then the case for September top-dressing is not at all strong. But if additional growth for hay or silage production is required, then top-dressing in September of established pastures may be well worth while.

It is usually profitable to apply phosphates to a pasture at the time of sowing or shortly afterwards. Such top-dressing tends to provide the seedlings with greater vigour, which assists them in passing successfully and more quickly through the critical young stage.

Grass-harrowing in September is likely to be very advisable on those paddocks on dairy-farms on which stock have been held for winter feeding. It is especially desirable to harrow at this stage fields from which it is intended to harvest hay or silage during the coming summer —the harrowing should be done just before the time of closing-up.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Spraying Operations.

By the time these notes appear, growers will be considering their spray programmes for the coming season, consequently it is necessary to see that all appliances used in spraying operations are in good working-order. Too many growers are apt to neglect these precautions, and, when spraying should actually start, find that their spray-pumps, pipes, taps, rods, or nozzles need attention. In consequence much valuable time is lost. Unfortunately for the grower, fungous diseases will not postpone development until all these defects are remedied. Many instances could be cited where growers have been heavy losers by not applying the initial spray at the proper time.

Overhaul of Plant.

Therefore it is strongly recommended that all those growers who have not, up to the present, overhauled their plant do so as soon as possible, in order to get a good start at the right time. The time of application of any spray is an important factor in the control of pests and diseases. Do not leave the ordering of the necessary materials until the last moment. It is better to have them stored in a shed ready for use than to be disappointed because the firm supplying the order is temporarily out of stock. Although spraying is an operation that the average orchardist does not look upon with any great favour, yet, if a good start is made with the first spray, future spraying not only appears easier, but growers are likely to secure more successful results.

There are quite a number of points to remember in successful spraying, and of all of them probably the most important are—(1) Proper plant; (2) proper materials; (3) proper time; (4) correct methods. All growers realize that no spraying can be successfully carried out without proper plant. Whether the plant be "stationary" or "portable," it must be of sufficient power to cope with all emergencies that are likely to occur during the spraying-season.

Proper Materials.

The question of proper materials needs some explanation, and owing to the fact that the use of any but the proper specifics may result in heavy loss to the orchardist. It appears that too many specifics are being placed on the market, many of them not tested claiming to be a " cure all " for the numerous pests and diseases to be found in the orchard. Growers are strongly advised to consider fully the matter before venturing with a more or less unknown and untested spray, but to stick to those materials which have been thoroughly tested under all conditions, and known to give the best possible results. Let the new specifics be experimented with at the places appointed for such work—viz., the research stations, before being used by the orchardist. In these days of increased costs, &c., a grower cannot afford to use any spray material that is not likely to be fully effective.

Time of Application.

The third point, the time of application, is an important one, and should be given every consideration by the grower. It must be remembered that all sprays for fungous diseases are applied in anticipation of attack, and that control depends largely in keeping a protective cover on the developing foliage and fruit until all danger of infection has passed. Although exact dates cannot be given for the different spray applications, all spray programmes are arranged in accordance with growth periods such as bud-movement, green-tip, petal-fall, &c. Therefore it is necessary that growers watch the development of their trees and spray accordingly. It must be stated that although all scheduled sprays throughout the season are necessary for the protection of clean fruit, the early sprays are the most important, and that time lost at this period cannot be recovered. Special reference is made to the " base " or " foundation " sprays, without which no grower can expect to get satisfactory results.

It is hardly necessary to dwell much on the fourth point—proper methods —except to state that thoroughness in application of sprays is a necessity. Some orchardists are inclined to rush through the spraying, just to get it finished, and later in the season they wonder why so much disease is prevalent in the orchard. An examination of the trees in such orchards after spraying would show that only a portion of each of the trees had been covered, leaving the balance unprotected from diseases. Good nozzles, adequate pressure, constant agitation of the spray, correct measurement of materials and mixing of the sprays, and complete coverage, are most essential.

Spray Schedules.

Slightly different spray programmes are necessary for each different fruit district in the Dominion, depending on the climatic conditions prevailing, consequently it is advisable for growers, when in doubt, to get into touch with the Orchard Instructor for the district, when all necessary information will be supplied.

As it will only be necessary to apply the initial or " foundation " sprays before further notes appear in the *Journal*, only these will be discussed here, deferring the issue of a general programme for the season until next month.

In arranging any spray programme due consideration must be given to the different varieties grown, and their susceptibility to injury or disease. Again both insect pests and fungous diseases must be considered. The three principal and well-tested sprays are winter-oil, lime-sulphur, and Bordeaux mixture. If San Jose scale is present a thorough application of winter-oil at strength 1–20 will be necessary ; this spray will also control mealy-bug, cottony-cushion scale and other scale insects. Lime-sulphur at strength 1–10 will also have a controlling effect on San Jose scale, as well as destroying many red-mite eggs. Bordeaux at a strength of 5–4–50 is undoubtedly the

best foundation spray in the majority of varieties for the control of black-spot, and will do much to ensure a clean crop throughout the season. Some growers, when considering the control of both insect and fungous diseases, combine the winter-oil with Bordeaux mixture. This is a saving of labour, &c., but it is preferable to use them separately. For the control of black-spot on pears a foundation spray of Bordeaux mixture at strength 5–4–50 should be applied, taking care to cover every part of the tree. Peach leaf-curl, brown-rot, &c., on stone-fruits can also be kept well in check by an application of Bordeaux mixture 5–4–50 when the terminal leaf buds begin to swell.

Cultivation.

In many instances the cultivation of the orchard is not given the attention necessary to enable the fruit-tree to function properly throughout the season. Some growers maintain that, providing a liberal supply of manure is given every season, cultivation does not matter. This is an erroneous idea, the proof of which can easily be seen in almost every district. The turning-under of the cover-crop should be proceeded with immediately, to enable rotting of the vegetable-matter to take place before the trees start into growth. Where no green crops were sown, the ploughing should have been completed before these notes appear, and the work of breaking down the furrows carried out as soon as weather conditions permit. Attention should be given to cultivation around the base of the trees. Neglect in this respect not only makes the orchard look unsightly, but creates a harbour for all kinds of pests and disease.

Manuring.

The depletion of the food from the soil by the yearly production of fruit is appreciated by growers, and much more attention is being paid to manuring than formerly. The value of green crops for the supplying of humus and nitrogen cannot be overestimated, but still a regular manurial programme is as essential as a regular spraying programme if success in orcharding is to be attained. Only a general outline with regard to manuring can be given, each district having its soil differences, in fact, each orchard presents a different problem. Generally speaking, a combination of the three essential elements—nitrogen, potash, and phosphates—give the best results, although in some instances modification is necessary. Growers should study their trees from year to year, watch results as far as growth, cropping, &c., is concerned, and apply manures to improve the fertility of the soil. If growth is lacking an application of nitrogen should be given, whereas if the fruit is lacking in colour, spurs weak, and crops small, potash should be applied. An application of carbonate of lime at the rate of 1 ton per acre every three or four years will do much to correct acidity in the soil, enable the bacteria to function, release plant-food, and improve the physical condition of the soil.

—George Stratford, Orchard Instructor, Motueka.

Citrus Culture.

Sweet oranges have been grown and sold in New Zealand for many years past, but the quantity produced by any one grower has, in most cases, been small. This condition has resulted in haphazard methods of harvesting and marketing, little study or attention having been given to ascertaining the most suitable dates for harvesting the different varieties. During the last two or three years in particular, this aspect of orange-culture has received greater attention and many observations have been made.

There are various scientific methods of determining when a sweet orange has reached that stage of maturity that it is suitable for dessert use, but it is not intended here to explain these technical methods. The sweetness

of the juice and the lack of acidity, as judged by the palate, is the simplest method of determining maturity. When making such tests it is a good practice to have in hand a good-quality imported orange for the purpose of making comparisons. When fully ripened, the principal varieties grown in New Zealand should be equally as sweet as the best imported fruit.

It is estimated that fully 75 per cent. of the sweet oranges grown and marketed in New Zealand are harvested before the most desirable stage of maturity has been reached. This common error of judgment has had the unfortunate result of creating the impression amongst many consumers that the New-Zealand-grown fruit invariably lacks sweetness, which is contrary to fact. Until this impression is removed, New Zealand oranges will not command the degree of popularity that they deserve.

No fixed dates can be set for the commencement of harvesting the different varieties, as both the season and the locality are liable to make considerable differences in this particular. However, under average conditions, there are few, if any, varieties that are fit for harvesting before the middle of July, and fruit that is reasonably fit for marketing at this date would certainly improve in flavour if left on the trees for a further few weeks. Late varieties such as Valencia, St. Michael, and Lue Gim Gong should never be harvested before October.

There is a danger with certain varieties, particularly certain strains of the Navel orange, for the fruit to lose its juice if allowed to remain on the tree for any appreciable period after reaching full maturity. There is evidence which indicates that trees grown on the citronelle stock are most likely to become affected in this way. The citronelle stock is also liable to cause the same trouble in Valencia oranges when allowed to remain on the trees until late November, although by no means does this occur in every instance. Young trees that are making vigorous growth are most susceptible to this trouble. Where the danger exists care must be taken to harvest the crop before the loss of juice commences.

New Plantings.

Where the planting of young citrus trees is contemplated, a thorough preparation of the soil is of great importance, and the work entailed is a profitable investment. The importance of providing adequate shelter before the trees are planted out cannot be overstressed. In most circumstances where shelter has not already been provided, the best results will be secured by planting the trees in nursery rows, where they should reman for one or two seasons while the shelter is growing. In most localities where citrus trees do well the present is a suitable time for planting. Where frosts are still to be expected, the trees should be protected; light brushwood arranged around the trees in pyramid form is a suitable method of guarding against frost damage, and at the same time affords protection from cold wind, without completely shutting out the beneficial rays of the sun. A heavy mortality rate in newly planted trees is not uncommon, especially when a dry period follows the planting. Probably the most common cause of this mortality is allowing the roots to become dry or partially dry before planting. Where this occurs no amount of irrigation after planting will completely counteract the detrimental effect.

Washington Navel Orange.

In view of the increased interest now being taken in the planting of sweet-orange trees, a word of warning appears to be desirable regarding this variety. In many orange-producing countries the Washington Navel is the most popular variety grown commercially, yet in New Zealand by far the greater number of trees of this variety are producing fruit of a very poor quality. The greatest factor in bringing

about this unfortunate result is believed to be lack of adequate bud selection, while the use of an unsuitable stock has also probably accentuated the position in many cases. The fact that a few Washington Navel trees in New Zealand are producing heavy crops annually of the best-quality fruit indicates that the fault does not lie in the variety. The poor strain of Washington Navel, as shown in the accompanying illustration, usually

WASHINGTON NAVEL TYPES.

Four on left inferior strains; two on right desirable.

has a thick rind, the partitions are irregular, and it is deficient in juice. Also, when allowed to remain on the trees for any appreciable period after reaching full maturity, the juice content rapidly diminishes. Fruit of the best strain, when the tree is grown on a suitable root-stock, will usually retain its full juice content on the tree until late in October, and sometimes even much later in the season.

—P. Everett, Orchard Instructor, Gisborne.

POULTRY-KEEPING.

The Eggs.

It is well known to every one that the small yet important and very palatable article of diet, the egg, is very commonly used, but it is doubtful whether many realize the full value of this item of food. Owing no doubt to its high food value and the ease with which it can be prepared, the egg is one of the most commonly used articles of food of animal origin. No other animal food can be used in so many varied ways, and got ready for use in so short a time.

The egg contains those food principles that best nourish the body, and we are told by those qualified to speak on such matters that the chemical composition of the egg and of the human body are nearly the same, and that ten eggs are equal in food value to 1 lb. of beef, but that one dozen

eggs would better serve a family of five or six. The egg is used in many different forms not only for adults, but for the child, the youth, the strong, and the invalid.

In addition to its food value, the egg is at times of value for other purposes. For instance, the white of the egg is a known remedy for burns. Egg-shells, on account of the purity of carbonate of lime contained therein, are sometimes used for the making of medicine. In his interesting survey of the poultry industry, Mr. E. J. Fawcett, Technical Liaison Officer of the Department of Agriculture, estimates that the approximate consumption of eggs in New Zealand is just on 300 per person per year, which means that the people of this Dominion, with its population of 1,578,757, consume approximately 39,469,758 dozen eggs each year. It has been estimated that England produces more than half the eggs consumed by its population, yet the latest statistics show that it costs that country some £16,000,000 sterling per annum for imported eggs.

Care needed.

The lack of appreciation of the perishable nature of the egg is causing a heavy annual loss in this country. The poultry business is one that depends to a great extent on the constant attention to detail in order to ensure success, and it is doubtful whether any branch of primary industry calls for more particular attention than the care and preparation of the egg for market. In fact, there is a great correlation between the successful poultry-keeper and the way he sends his eggs to market.

Desirable Qualities.

Freshness, cleanliness, and flavour are the most desirable qualities in a good marketable egg, and there are few other products where value depends more directly on flavour and freshness than the egg.

When a fertile egg is exposed to a certain temperature, whether it be under a hen, in a hot kitchen, a warm store-room, or elsewhere, the embryo starts to develop, with the result that its flavour is soon spoiled.

It has been proved beyond doubt that the male bird has no influence on the number of eggs a hen will lay. The infertile egg will keep much better, therefore, unless the eggs are required for incubation purposes, there is no advantage in keeping males running with the flock.

The egg will very quickly take up or absorb objectional odours or mustiness, and for this reason care should be taken when eggs are being held for market to see that they are kept away from such materials as kerosene, paint, onions, fruit, &c.

Mustiness.

Mustiness is one of the worst defects in an egg that a baker has to contend with, owing to the fact that it is almost impossible to detect the mustiness except by tasting it.

As the chief causes of mustiness are due to the egg being laid in damp straw, damp or soiled nests, or being forwarded to market in damp, soiled fillers, every care should be taken to see that plenty of dry, clean nests and nesting material is supplied, and that the eggs are collected at least once a day and sent to market in clean, dry fillers or containers. Experiments have proved that an egg kept in a temperature between 50° and 60° F. will be fresher at the end of three weeks than when kept in a temperature of 70° F. for a week, and for that reason the egg should always be stored in a dry, cool place.

The Local Market.

The building-up of the poultry industry and placing it on a higher plane will depend, very largely, on the poultry-keeper, how he sends his eggs to market, and how he caters for his very best customer—namely, the local consumer.

Several years of supervising the grading of eggs for export has shown, as a rule, that the large producer who depends chiefly upon the sale of the commercial egg does send his produce to market regularly and in an attractive condition, but, unfortunately, a number of the more-or-less small producers, or, may it be said, the uninterested poultry-keepers, fail to give that little extra care and attention to the egg before sending it to market, and which has such an influence on the sale.

On one occasion while supervising the grading for export a consignment of 1,500 dozen eggs arrived at the export floor from country stores. After examining the contents of nine cases (225 dozen) it was found that owing to the soiled condition of many of the eggs only 20 dozen could be found suitable for export. The result was that the whole consignment had to be rejected and sold at a much reduced price, owing to the fact that it would not pay to grade such a line. Since then country store eggs have not been in demand for export purposes.

It was a pity to see such a consignment of good food, and one so uniform in quality when produced, sent to market in such a state, especially when the country egg, produced by birds kept under natural conditions, is of the very best quality when laid. Many small producers seem to think that because their output is small the few eggs that they send to market do not really count. This is a mistaken idea, for when it is remembered that the last census returns showed that of the 165,949 householders keeping poultry in this country, 134,140, or over 80 per cent. of the total, were keeping under twenty-five birds, and as a very large number of these householders sell eggs during the flush season, it will be realized that their collective output and the manner in which they are sent to market has a very big influence on the local price, also in creating the summer surplus.

Export-trade.

During last egg export season some 338,430 dozen eggs were exported from New Zealand to the London market. This represents a very small percentage of the annual local consumption. Although the prospects of building up a big profitable egg-export trade are by no means bright, the economic importance of sending our small summer surplus overseas cannot be overestimated, for it is that surplus that often has the effect of bringing the local price down below the cost of production.

The export season is just at hand, and as this is a matter that concerns all producers it behoves all, both large and small poultry-keepers, who sell eggs to see that all eggs are sent to market in a fresh, clean, and attractive condition.

Some may think that the estimated consumption in this country of 300 eggs per person per annum is high, but the following may be of interest. The estimated consumption of eggs in Canada during 1920 was 202 per person. During 1921 the Canadian Government, at the request of those interested in the egg trade and with the hope of encouraging a greater consumption, introduced regulations whereby eggs before being placed on the local market had to undergo inspection. The result was that in five years' time the consumption of eggs in that country had gone up from 202 to 337 per head of the population, and now is over 400.

There are good grounds for assuming that if all eggs were sent to market in a clean and attractive condition, and they were a guaranteed fresh article when they reached the consumer, the consumption in this country would be much increased, with a consequent financial benefit to the producer.

Eggs by Air-mail.

In order to test out the above method of transport, this Department arranged with the High Commissioner for New Zealand in London, and on 23rd May a box containing fifteen White Leghorn eggs from England was sent forward from Southampton Airport. The eggs

arrived in Wellington on the 15th June, and were taken to this Department's Poultry Station at Wallaceville. Eight of the eggs were placed under a hen, and the remainder in an incubator. At the end of fourteen days there were sure indications that none of the eggs would hatch.

The experiment, although interesting, would indicate that it is not possible at present to get results from hatching eggs when sent so far by air-mail.

C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Breeding.

Colonies in normal condition should now have a good quantity of sealed brood in the combs, with young bees emerging every day. The queens will be laying well, though not up to their full capacity, but their powers in this direction will increase with the approach of warmer days. The first bees bred this season will be acting as field-bees, and the older autumn-bred ones will be dying off rapidly. Breeding should be kept going steadily without a break, as it is necessary that each colony should grow in strength in order to be in a condition to take advantage of the first flow from the early nectar-secreting plants.

Food and warmth are the main factors in promoting steady breeding, and these should have constant attention. It is well to remember that when breeding is in full swing a considerable amount of food is used up every day for the feeding of the brood. All through the spring, when weather conditions are favourable, some nectar can be gathered, and often a good deal is stored, which helps to supplement the stores in the hive. However, there are times when, through bad weather, the bees are unable to do this. Where such conditions last several days the food-supply will diminish rapidly, and the bees may be reduced to starvation before the beekeeper is aware of their condition. August and September are critical months in this respect, and if a spell of bad weather is experienced it is well to ascertain the condition of the food-supply in each hive, and feed without delay where necessary.

Hints to Beginners.

There are a few points which every beekeeper should bear in mind when starting an apiary. The stocks must be clean and in good condition. No beekeeper can hope to succeed with poor bees, and no one but a novice would tolerate other than strong colonies. The hives should be well made and painted. Cracks and knot-holes may be of use for ventilation in the summer, but at any other time of the year they absorb much of the bees' time in gathering propolis to stop the draughts. Moreover, any holes except the entrance offer an inducement for robbers to investigate, and necessitate the bees employing extra guards to prevent attack. A careful watch should be kept on the stores, so that the bees may not starve. It is far better to overfeed than underfeed, for, as already indicated, it is amazing how quickly a colony will deplete its stores when brood-rearing commences in the spring. More feeding means more brood ; but, once commenced, it must be continued until the hives show actual proof that they are gathering sufficient nectar to keep themselves going. Feed only in the evening, inside the hives, and use a syrup in the proportion of two parts water to one part sugar ; dissolve thoroughly and feed as soon as it has cooled sufficiently to be harmless to the bees.

Provide permanent shelter. A live hedge is the best, if kept trimmed to a height of 8 ft. or 10 ft. Failing this, some kind of breakwind is essential.

The hives should never be exposed to high winds, as, in addition to the danger of the roofs being blown off, cold draughts check brood-rearing to a very great extent.

Open the hives only on warm, still days. Make necessary observations as quickly as possible, and take a note of them at once. The inside of the cover makes a good rough diary, and does not get lost or mislaid; mark the date of each examination. Endeavour to distinguish the sex of the brood at a glance, and keep a sharp lookout for the queen; she is easily distinguished by the length of her body and the comparative shortness of her wings. Try to make a rough estimate of the weight of each frame as you lift it, comparing it in your mind with that of an empty comb, thereby arriving at some idea of the quantity of stores in each hive. Do not try to run many hives until the rudiments of the business have been grasped, but be content with one or two strong colonies until the learner's stage has been passed.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

WITH most of the early crops under way consideration is now given, during the month of September, to the planting and sowing of main crops, such as potatoes, turnips, salsify, carrots, peas, leeks, lettuce, spinach, and also salads; towards the end of the month sowing Brussels sprouts, savoy, cauliflowers, and celery for December planting. These operations, together with the preparation of the land so soon as it is available for planting out half-hardy crops towards the end of October or beginning of November, makes this season a busy time in the garden when the interruptions of stormy intervals are taken into consideration. Where the land is heavy or the drainage indifferent so that drying is slow the management often has a trying time.

In the June number of this *Journal* the names and addresses of seed-potato growers receiving provisional certificates for the crop were published. The acreage of seed of each kind indicates the outstanding popularity of the main-crop varieties Aucklander Short Top and Dakota, the former being an easy favourite. The Aucklander Short Top is a selection from Sutton's Supreme made by a grower in Kaiapoi and introduced into commerce in 1910. A further selection of the same origin made a few years later is known as Aucklander Tall Top. It is one the heaviest croppers, but later in ripening; and, although the tubers are somewhat similar, they have not the quality of the Short Top. Dakota was produced in America some years ago. Its red, oval shape and good keeping and cooking qualities are well known. Other main-crop varieties well represented among the certificated seed crops are Arran Chief, King Edward, Inverness Favourite, and Arran Banner. Light cultivation is given during fine weather, after planting potatoes and before germination has taken place, so soon as a crop of seedling weeds makes its appearance or a crust forms on the surface of the land. The crop may be harrowed lengthwise with the rows without injury until the plants are well above the ground. This attention will save a great amount of hand-work. After the plants are well above the ground the first cultivation given is deep and carried close up to the plants. Later it is shallower and farther away with a view to avoiding injury to the roots.

A culinary turnip of excellent flavour, keeping quality, and early maturing is Purple Top or Early Milan. In districts where the season is too short for sowing an autumn crop of carrots a main crop of a

good intermediate variety is usually sown towards the end of the month of September—they are then in better condition for use in winter than if sown earlier. Fresh green peas in the spring are something of a luxury, as they may only be grown on limited areas in select localities; an early crop in bigger supply is available about the month of December and is very popular. Later the supply often falls off rather quickly, and this can be avoided by sowing at intervals up to the month of December inclusive. For planting out in January on land from which an early crop has been taken a sowing of leeks should be made now. The crop is hardy and little troubled with pests, it is a winter crop of the greatest utility, and is most useful and agreeable if grown to a moderate size only. New Zealand spinach is found growing wild on our light coastal lands. For use in summer when a supply of good, clean, green vegetables is often scarce it should be more often planted in the garden. It is not easily packed for the market, but for home use it is quite suitable and will satisfy the most critical tastes. To obtain early plants it is sown now in boxes in a frame for planting out towards the end of October, but otherwise it requires little attention if given a warm position. Silver beet is another vegetable of this class which may be sown now where summer cabbage of satisfactory quality is difficult to grow.

Plants of the cabbage family will now be subject to the attack of white butterfly larvæ and other pests, but satisfactory protection is afforded by dusting the plants lightly with derris, an extract from the roots of a tropical plant. It may be obtained from any seedsman, and is best obtained fresh, as it is inclined to depreciate if carried over into a second season. This material is non-poisonous and is preferable to arsenate of lead as a remedy for these pests when attacking plants of the cabbage family.

In growing celery it is to be remembered that one is dealing with a marsh plant—that is a plant requiring an abundance of humus and water. The land, however, must be well drained so that the water is not in the least stagnant. For commercial cropping the land should be naturally light, rich, and moist, or there should be good facilities for irrigation. Where the land is inclined to sometimes dry out the crop is planted in trenches. The September sowing may be made outside on suitable land. Broadcast a light dressing of superphosphate and maintain a clean fallow sufficiently long to destroy weed seeds, and then sow in drills a few inches apart. Mulch lightly with well-decayed manure and water well with a fine spray. When the plants are about 3 in. high they should be "wrenched" by cutting the tap root a few inches beneath the surface of the ground, using a bright sharp spade or similar implement. This is best done in dull weather when rain is threatening.

Small and Sundry Fruits.

Established brakes of hardwood plants of this class will require light cultivation to suppress weed-growth and work in any artificial fertilizers that may be necessary to supplement the winter dressing. It is important the cultivation should be light, as any disturbance of the roots at this season will seriously interfere with growth and cropping. As regards fertilizers, the potash requirement should not be overlooked, especially for gooseberries, red currants, and raspberries; it improves the quality of both the wood and the fruit. Where plantations are approaching the end of the term of their useful life plans should be made for new plantings to be made on fresh land next season where a similar crop has not been grown during the past three years. Planting of this class to be done during the present season should be completed without delay, giving careful attention to pruning. Young raspberry canes, planted this season, should now be cut back to a length of about 8 in. to encourage strong sucker-growth.

Culinary and dessert fruits usually planted out during the month of October include tomatoes, passion-fruit, tree-tomatoes, Cape-gooseberries, melons, cucumbers, and—during the month of November—peppers and egg-plants. Most crops of this class require a light, rich soil in a warm, sheltered position. In many instances the land to be planted is at present occupied with a winter or spring crop such as cabbage, but the preparation of the land should be commenced promptly so soon as the present crop is cleared so that it may have time to settle and cleaning may be done. In deciding on a formula for manuring the present condition of the land must be taken into consideration. For instance, where a generous dressing of organic manure has been applied for the previous crops and a tomato crop is to follow, phosphates and potash will be the main requirements, while if the supply of nitrogen in the land is inclined to be high the amount of potash applied may be increased proportionately. Most of the plants mentioned will have been raised under glass and require to be gradually accustomed to outside temperatures and other conditions before planting out. This operation, known as " hardening off," must be done with consideration to avoid a serious check in the growth of the plants. It generally takes about a fortnight, during which time the plants are placed in a frame with a well-sloped canvas cover which can be used during hard weather. It is done most successfully when the plants have been grown steadily from the commencement and given air at every reasonable opportunity.

The Homestead Garden.

In most districts the present time is the peak of the planting season for both hard-wooded plants—trees and shrubs and for softwoods—and hardy herbaceous perennials. For most kinds planting is best done now when the land is sufficiently dry. In readiness to take advantage of such opportunities the plants should be obtained and heeled-in in friable soil in a convenient position. Most kinds of hard-wooded plants should have the branches thinned out and shortened well back to " outside " buds after planting. This is done with the greatest consideration with a view to obtaining a well-spaced, strong framework, of the desired design, quickly. When setting out young trees especially, planters often lack the courage to prune sufficiently hard. Exceptions in the treatment of young plants of this kind are climbing hybrid trees and perpetuals, and varieties of the class Pernetiana. These are thinned out moderately and shortened back lightly.

Among the hardy herbaceous perennial plants set out now consideration should be given to violet varieties and species of helleborus which have provided a welcome display of blossom during the winter months. Both require a rich, moist soil that does not dry out in summer. The hellebore species are chiefly natives of Balkan countries and thrive best in shaded positions. The month of September is a suitable time for repotting most kinds of house plants that may require it. It is important to make the soil rich and light by mixing with good, fresh loam a generous amount of humus in the shape of leaf-mould or thoroughly decayed manure and sharp sand ; this is best done at least some days before it is used.

Where new lawns are to be made by seeding or turfing the work should be completed as soon as weather permits. It is most urgent in localities where a dry summer season is sometimes experienced. As stated before, the surface should not only be smooth, but it should be of correct height and graded in such a way as to dispose of surface water in a satisfactory manner. Adjustments of this kind must not be hurried, but completed satisfactorily before laying turf—or sowing seed—during a period when there is no wind.

The high condition of sports greens, subject to frequent rough usage, is only maintained by constant attention and feeding. Although it is not always realized it is a fact that a good lawn is one of the most important features in the garden. A close, fine turf is very attractive and makes the best setting for buildings, trees, and shrubs in the vicinity. Fenced

off from grazing stock and closely cut, the plants making up the turf are soon short of nourishment, and weeds find an easy footing. The desirable turf condition is only maintained by supplying suitable manures and fertilizers. A lawn on light land requires liberal dressings of organic manures during autumn or spring—sometimes at both seasons. These should be in a finely divided state to facilitate even distribution. Most lawns, however, are greatly improved by dressings of sulphate of ammonia and sulphate of iron during the spring-time and superphosphate in early autumn. The spring-time dressing should now be given after the larger perennial weeds, such as rib-grass and cats-ear, have been removed. It may be composed of three parts sulphate of ammonia and one part of finely ground sulphate of iron by weight and applied on two or three occasions at monthly intervals at the rate of 1 oz. to the square yard. It is most convenient to mix the fertilizers with about five parts of fine, dry sand or old potting soil.

Wm. C. Hyde, Horticulturist, Wellington.

ANSWER TO INQUIRY.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GROWING OF LUCERNE.

E. A. M. L., Dannevirke :—

In November, 1936, I sowed some lucerne, using 8 lb. of seed per acre. A neighbour of mine had used this amount with success, but I found it insufficient. The lucerne plants that did spring up had rather a bad time with the sorrel, and later with Californian thistle and grass. I ploughed the area, which was in grass, to a depth of 8 in. in early July, worked it up very thoroughly, and in October put on a ton of lime (carbonate) per acre. A fortnight later I added 5 cwt. of superphosphate per acre, and worked it into the ground, and again a fortnight later, early November, I drilled in the lucerne-seed (7 in. drills) after having mixed it with culture supplied by the Department of Agriculture. At the time of sowing I used 2 cwt. of blood and bone manure per acre.

I have fenced the area, which required over 500 yards of fencing, and have planted Lawsonianas all round the paddock, so I am most anxious, having gone to this expense, to have a stand of lucerne. The soil is naturally well drained and should be ideal for growing lucerne. I am afraid the Californian thistle will become worse with further cultivation. Will you please advise me as to the best course to take now, giving me full details.

Fields Division :—

The general preparation and manuring appears to be satisfactory ; the mention of sorrel and grass, however, would indicate a seed-bed tending to be loose and open, and the use of a roller on the plough furrow before disking and again on the seed-bed before sowing would assist in getting a good take of lucerne, which likes a clean and firm seed-bed. 8 lb. of seed per acre is generally considered too light a sowing. From 16 lb. to 20 lb. is the general practice to ensure a sufficiently dense cover of young lucerne to compete with weeds. Owing to the liability of damage to the culture, it is not advisable to use a nitrogenous manure such as nitrate of soda or sulphate of ammonia, or an organic fertilizer such as blood and bone, with the seed. Blood and bone is also liable to affect germination under some conditions. The improvement of a poor stand, particularly under the conditions indicated in your letter, is a difficult problem, and one best discussed on the area. Surface-sowing of more seed after cultivation is generally unsatisfactory, as the young seedlings are smothered by the older lucerne-plants, and by weeds, which it is often impossible to eradicate.

WEATHER RECORDS: JULY, 1937.

Dominion Meteorological Office.

NOTES FOR JULY.

THE cold weather, with a prevalence of southerly winds which had characterized June, persisted through the first eight days of July, but thereafter weather of a more westerly type prevailed and conditions were definitely milder. Towards the end of the month some beautiful days were experienced in most places. Rainfall was generally much below and sunshine above average, but nevertheless the weather during the month was rather unsettled and, except in eastern districts, more especially in the South Island, rain, though often light, was rather frequent. Over western and central districts of the North Island the soil was continually damp and muddy, and conditions on the farms were unpleasant. There was little growth of vegetation. In Canterbury and Marlborough, on the other hand, it was possible for some arrears in agricultural operations to be made up in numbers of places. The area under crop is, however, likely to be considerably less than during last year. Stock, except hoggets, are reported as doing well, but a spell of dry and sunny weather would be welcome. Early lambs have appeared in numbers of districts, and so far the losses have been light.

Rainfall.—Except in comparatively small and isolated areas the rainfall was much below normal. In Marlborough and Canterbury the totals were particularly low.

Temperatures.—Temperatures were almost everywhere below normal, though the departures nowhere amounted to 2° F.

Sunshine.—Though below it at a few places, more especially on the west coast, sunshine was generally considerably above average.

Storm Systems.—On the 1st a cyclonic depression was centred over North Auckland. Easterly gales blew in the far north and south-easterlies in Taranaki. There were some heavy rains in northern districts. By the 3rd the depression had moved away and an anticyclone had enveloped the Dominion. The centre was, however, far to the south, and cold southerly winds persisted.

On the 5th a depression, with a considerable extension in the south-to-north direction, advanced from the Tasman Sea and crossed the country during the night. On the 6th strong south-westerly winds were blowing. This storm caused general rains. Snow was widespread in the South Island and reached low levels on the mountains in the North. Some very severe frosts followed.

From the 9th to the 17th there was another unsettled spell. This began with a series of westerly depressions, but from the 14th an intense anticyclone covered Australia and extended over the Tasman Sea, while several depressions followed each other on a southerly course off the east coast of New Zealand. Southerly gales blew on the 16th to 17th. Snow again fell to low levels on the ranges, while there was hail and thunder in many places.

The improvement which followed was only brief, and between the 19th and the 22nd another series of depressions passed. Some heavy rains fell in western districts. There was considerable thunder and hail on the 22nd, and two men were struck by lightning near Otorohanga.

An anticyclone covered the Dominion on the 23rd and 24th, but westerly depressions were soon again following each other across the South Island. There was heavy snow on some of the ranges on the 27th, and hail and thunder were reported for the third time during the month. The last three days saw a considerable improvement.

RAINFALLS FOR JULY, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Fall.	Total Rainfall to Date.	Average Rainfall to Date.
		North Island.				
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	..	..	..	5·48	..	33·64
Russell	4·56	13	2·37	6·72	68·28	37·34
Whangarei	5·62	23	1·18	7·19	57·37	38·79
Auckland	4·23	25	1·21	5·58	30·22	29·86
Hamilton	..	..	..	5·10	..	29·00
Rotorua	2·44	14	0·86	5·00	30·88	31·85
Kawhia	..	..	..	6·01	..	31·55
New Plymouth ..	6·51	23	1·18	6·38	38·59	34·92
Riversdale, Inglewood ..	8·96	20	1·82	10·06	60·55	58·71
Whangamomona ..	..	..	..	7·27	..	42·97
Hawera	3·88	17	0·71	4·22	26·62	25·61
Tairua	6·77	17	1·53	6·31	37·48	39·87
Tauranga	3·57	17	1·34	4·94	33·68	31·82
Maraehako Station, Opotiki	8·38	13	2·53	4·45	40·02	32·24
Gisborne	3·66	15	0·79	5·05	22·74	29·96
Taupo	2·29	12	0·84	3·87	20·60	25·23
Napier	3·27	11	1·45	3·27	14·84	19·35
Hastings	2·03	10	1·15	3·66	11·44	20·29
Taihape	2·36	19	0·50	2·97	20·02	20·78
Masterton	4·28	17	1·30	4·18	21·06	22·95
Patea	2·83	19	0·66	4·23	27·16	25·63
Wanganui	1·22	11	0·25	3·34	20·31	21·04
Foxton	0·78	7	0·30	3·11	13·90	18·38
Wellington	3·93	16	0·81	4·85	22·59	25·74
		South Island.				
Westport	8·46	17	1·86	8·30	50·64	54·80
Greymouth	8·23	21	2·05	7·93	64·33	57·49
Hokitika	7·28	20	1·82	8·96	66·90	64·05
Ross	5·65	14	1·35	9·18	77·29	71·95
Arthurs Pass	..	..	..	9·93	..	85·87
Okuru, South Westland	12·69	9	2·20	10·52	91·30	82·56
Collingwood	6·35	10	2·40	9·40	53·82	54·96
Nelson	3·40	8	1·12	3·48	22·01	21·80
Spring Creek, Blenheim	1·18	8	0·42	3·42	15·95	17·89
Seddon	0·72	7	0·31	2·40	14·02	14·72
Hanmer Springs ..	2·57	10	0·61	4·29	20·32	26·06
Highfield, Waiau ..	1·18	6	0·33	3·34	13·47	30·08
Gore Bay	1·34	9	0·31	2·80	20·26	18·67
Christchurch	1·91	8	0·93	2·54	14·71	15·17
Timaru	0·37	6	0·15	1·84	13·60	12·98
Lambrook Station, Fairlie	0·69	7	0·33	2·62	12·30	14·60
Benmore Station, Clearburn	..	..	..	1·74	..	14·54
Oamaru	0·56	6	0·29	1·72	10·49	12·70
Queenstown	1·39	12	0·67	2·03	18·67	17·38
Clyde	0·24	3	0·12	0·90	10·37	8·66
Dunedin	1·59	13	0·31	2·98	28·16	21·06
Wendon	1·64	11	0·32	1·74	29·34	17·22
Balclutha	1·46	11	0·49	1·78	23·18	14·49
Invercargill	3·48	19	0·60	3·27	28·31	26·58
Puysegur Point ..	7·93	24	1·07	6·15	56·23	48·41
Half-moon Bay ..	..	..	..	4·40	..	33·53